Title: Assessment of National Aquaculture Policies and Programmes in Zambia

Author: Hangoma Gordon Mudenda
Institute for Policy Studies (IPS), P. O. Box 30752, Lusaka, Zambia

Email: hgmudenda@yahoo.com

Date of Publication: November 2009

Keywords: Aquaculture; Zambia; Department of Fisheries; and Fisheries Policy

Note:
1. This document is one of a series of 10 sub-Saharan African analytical in-country aquaculture policy reviews produced by the SARNISSA project in 2009. All of these reviews can be viewed and downloaded from the www.sarnissa.org website.
2. The views and opinions stated in this review are those of the author and not necessarily those of the SARNISSA project or the EC.
SARNISSA : Sustainable Aquaculture Research Networks in Sub Saharan Africa

COORDINATOR

UNIVERSITY OF STIRLING
Institute of Aquaculture
Stirling
FK9 4LA
UK

Dr Little, David
E-M : d.c.little@stir.ac.uk
TEL :44-1786-467923
FAX : 44-1786-472133

CONTRACTORS

CENTRE de COOPERATION INTERNATIONAL en RECHERCHE AGRONOMIQUE pour le DEVELOPPEMENT, Dept PERSYST/UR Aquaculture
BP. 5095 TA B – 20 /01, Montpellier Cedex 1, 34033, France

Dr Jérôme Lazard
Tel. + 33-4-67046365
Fax +33-4-67635795
E-mail: jerome.lazard@cirad.fr

WORLD FISH CENTRE (CAIRO), IITA Humid Forest Center BP, 2008 (MESSA), Yaounde 11278
Cameroon

Dr Randy Brummett
Tel. + 237-2237-434
Fax +237-2237-437
E-mail: r.brummett@cgiar.org

CAB INTERNATIONAL, Nosworthy Way, Wallingford, OX10 8DE
United Kingdom

Dr Gareth Richards
Tel. +44-1491-829442
Fax +44-1491-833508
E-mail: g.richards@cabi.org

ASIAN INSTITUTE OF TECHNOLOGY, 58 Moo 9 KM4L, Paholythin, Highway Klong Nueng, Klong Luang, Pathumthani 12120, Thailand

Ram C. Bhujel
Tel. +66 02 524 5472
Fax +66 02 524 6200
E-mail: Bhujel@ait.ac.th

BUNDA COLLEGE, UNIVERSITY OF MALAWI, Bunda College, Lilongwe, Box 219, Malawi

Dr Emmanuel Kaunda
Tel. + 265-1-277-240
Fax +265-1-277-364
E-mail: ekuanda@bunda.unima.mw

INSTITUT de RECHERCHE AGRICOLE pour le DEVELOPPEMENT, IRAD, BP 2067/2123 Yaounde, Cameroon

Dr Victor Pouomogne
Tel. + 237-22-23-3538
Fax +237-22-22-3362
E-mail: pouomognev@yahoo.fr

ETC FOUNDATION, Kastanjelaan 5, Leusden, 3833AN, Netherlands

Marielle Dubbeling
Tel. + 33-565-741951
Fax + 31-33-4940791
E-mail: m.dubbeling@etcnl.nl
ACKNOWLEDGEMENTS

This study on Aquaculture Policies in Zambia was commissioned by the World Fish Centre. I am grateful to the administration of the project for their support throughout the study. In the course of my work as consultant assigned to conduct the study in Zambia I have received encouragement and support from all stakeholders involved in aquaculture development. I am particularly grateful for the assistance received from representatives of organisations contacted in the implementation of the study.

In the implementation of the study, the consulting team worked in close collaboration with officers of the Department of Fisheries in the Ministry of Agriculture and Cooperatives. The Consulting team is grateful to the Director, Mr. C. T. Maguswi for his assistance in facilitating the study. I am very grateful to Mr. John Mwango, Chief Aquacultural Research Officer, in the Department of Fisheries for sharing information on current aquaculture project in the Department of Fisheries. Mr. Martin Chilala, Chief Fish Culturist, for providing the most recent documents on aquaculture in Zambia. Mr. Killian Kalonga Chief Fisheries Officer provided the latest documents on fisheries legislation and the draft fisheries policy document.

Consultants for the study are very grateful to Mr. Kenneth Mazingaliwa former Senior Aquacultural Research Officer in the Department of Fisheries and Officer In-Charge at the National Aquaculture Research and Development Centre for providing a detailed description of programmes of the centre and putting at the disposal of the consulting team details of the ICAT programmes. Mr. R. M. Chitembure Senior Statistician at the Central Board of Heath assisted the consulting team in the analysis of data collected from the field.

Mr. Malcom Dimuna, Fisheries Assistant Based in Siavonga for updating the information on cage fish farming on the Zambian side of Lake Kariba

Most information collected in the study was through interviews with farmers and representatives of various organizations who provided information about aquaculture. I am very grateful to the farmers who willingly provided information for the study.
# ABBREVIATIONS AND ACRONYMS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACP</td>
<td>Agriculture Commercialization Programme</td>
</tr>
<tr>
<td>ADSP</td>
<td>Agricultural Development Support Programme</td>
</tr>
<tr>
<td>ALCOM</td>
<td>Aquaculture for Local Communities Development Programme</td>
</tr>
<tr>
<td>ASIP</td>
<td>Agriculture Sector Investment Programme</td>
</tr>
<tr>
<td>ASP</td>
<td>Agriculture Support Programme</td>
</tr>
<tr>
<td>COMESA</td>
<td>Common Market for Eastern and Southern Africa</td>
</tr>
<tr>
<td>CBU</td>
<td>Copper-belt University</td>
</tr>
<tr>
<td>DOF</td>
<td>Department of Fisheries</td>
</tr>
<tr>
<td>DACO</td>
<td>District Agriculture Co-ordinator</td>
</tr>
<tr>
<td>EBZ</td>
<td>Export Board of Zambia</td>
</tr>
<tr>
<td>ECZ</td>
<td>Environmental Council of Zambia</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental Impact Assessment</td>
</tr>
<tr>
<td>EPZ</td>
<td>Export Processing Zones</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
</tr>
<tr>
<td>FNDP</td>
<td>Fifth National Development Plan</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>HPZ</td>
<td>High Potential Zones</td>
</tr>
<tr>
<td>HRD</td>
<td>Human Resources Development</td>
</tr>
<tr>
<td>ICARA</td>
<td>International Conference for Assistance to Refugees in Africa</td>
</tr>
<tr>
<td>JICA</td>
<td>Japanese International Cooperation Agency</td>
</tr>
<tr>
<td>JFRO</td>
<td>Joint Fisheries Research Organization</td>
</tr>
<tr>
<td>MACO</td>
<td>Ministry of Agriculture and Cooperatives</td>
</tr>
<tr>
<td>NaqS</td>
<td>National Aquaculture Strategy</td>
</tr>
<tr>
<td>NARDC</td>
<td>National Aquaculture Research and Development Centre</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Government Organization</td>
</tr>
<tr>
<td>NAIS</td>
<td>National Agriculture Information Service</td>
</tr>
<tr>
<td>NORAD</td>
<td>Norwegian Agency For Development</td>
</tr>
<tr>
<td>NRDC</td>
<td>Natural Resources Development College</td>
</tr>
<tr>
<td>PACO</td>
<td>Provincial Agriculture Coordinator</td>
</tr>
<tr>
<td>PRSP</td>
<td>Poverty Reduction Strategy Paper</td>
</tr>
<tr>
<td>R &amp; D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>PSRP</td>
<td>Public Service Reform Programme</td>
</tr>
<tr>
<td>SADC</td>
<td>Southern Africa Development Community</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
</tr>
<tr>
<td>UNZA</td>
<td>University of Zambia</td>
</tr>
<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
</tr>
</tbody>
</table>
EXECUTIVE SUMMARY

The study on Assessment of Aquaculture Policies and Programmes in Zambia was undertaken in December 2008 and January 2009 as part of the European Commission funded SARNISSA project (www.sarnissa.org). Details of the study and the Terms of Reference are given in this report as an appendix. The main objective of the study as indicated in the Terms of Reference was to review policies and programmes for aquaculture development programmes and projects implemented in Zambia focusing mainly on the last ten years. To realise this objective, a detailed description of the aquaculture sector in the country, including capture fisheries, is provided. A brief review of the capture fisheries in the country and its characteristics was also undertaken, because changes in natural fisheries have influenced policy relating to aquaculture development.

The structure of the Department of Fisheries (http://www.afdevinfo.com/htmlreports/org/org) is analysed and changes that have taken place since the Department was established are described. This is important because the institutional arrangements and the structure of the Department of Fisheries play a role in the provision of services to the sector. Changes in the policy environment have on their turn influenced the structure of the Department.

The study was carried out in collaboration with the Department of Fisheries, the Ministry of Agriculture and Cooperatives (http://www.afdevinfo.com/htmlreports/org/org_26445.html) and other stakeholders. In the implementation of the study, the Chief Aquaculture Research Officer and the Chief Fish Culturist in the Department of Fisheries were consulted at different times. Available documents on aquaculture and fisheries in Zambia were reviewed in order to assess the potential for the development of aquaculture. Aquaculture and fisheries training staff were consulted, whilst interviews with fish farmers were conducted.

Compared with other food production systems, aquaculture is relatively new in Zambia. Aquaculture is however making an impact on the nutrition of rural communities and this is attributed to several aquaculture projects that have been implemented by the Department of Fisheries, in collaboration with various donors. Through implementation of these development projects, aquaculture has proven to be a potential and acceptable food production system. However, aquaculture has not yet been developed to a level where it is a major income generating activity among rural and peri-urban households.

Several types of aquaculture are practiced in Zambia. These can be classified into land based systems and floating cages. In general, land based systems often utilise indigenous fish species, such as the three spotted bream, Oreochromis andersonii, the green headed bream, Oreochromis macrochir and the red breasted bream Tilapia rendalii. Most small scale fish farms employ polyculture of these indigenous breams. However, the more successful large scale operations practice mono-culture of Oreochromis andersonii. Floating cages have concentrated on the Nile Tilapia
Oreochromis niloticus. However, even small scale farmers are increasingly opting for this species, as they are easily available. This has prompted the DOF to confine the use of niloticus within the Kafue basin and lower Zambezi. The most common type of aquaculture among small-scale farmers involves pond fertilisation using the crib system. This is a method where vegetative material (farm vegetable wastes, farm weeds and other green manures) is deposited in an enclosure constructed within a fishpond. The crib is widely used, particularly among small scale rural farmers without livestock. Another form of pond fertilisation commonly used is integration with livestock production. Integration with pigs is the more common form of livestock integration among the large and medium scale commercial farmers. In peri-urban areas chicken wastes, either obtained from the farm itself or from other sources is less common. However, chicken and cow manure are utilised among farmers who will not employ piggery wastes for religious reasons. This is common among Adventists and Muslims. Cage fish farming and fingerling production was introduced around 2001 by Kapenta fishers in Lake Kariba (http://www.cse2000.org/html/kapenta_fishing.html) who have diversified into fish farming following the example of Lake Harvest Corporation (www.lakeharvest.com/) operating on the Zimbabwe side of the Lake. A more direct stimulus to the growth of floating cage culture is the establishment of a commercial Nile Tilapia hatchery by the Chirundu Bream Farm (http://full-o-fish.com/index.htm) downstream of the Zambezi River. This study makes an assessment of different aquaculture systems and attempts to analyse which policies should be put in place and applied to enhance the growth and development of the aquaculture sector in the country.

In general, small scale pond culture productivity is low. This is because the main objective of this class of farmers is household subsistence. Often, it is low stocking densities – usually one fish per square metre and poor pond fertilisation – often without fertilisation and inadequate crib design and maintenance - which are the reasons for low productivity. Commercially oriented farmers employ higher stocking densities and employ feed supplementation practices in addition to recommended pond fertilisation. The latter operations can achieve internationally comparable productivity levels. It is increasingly being accepted that poor pond productivity levels discourage many of the new and potential fish farmers. The government is therefore exploring a number of measures to improve productivity of small scale operators and to improve profitability through commercialisation. It is therefore recommended that in future aquaculture programmes, there should be more emphasis on commercialization of aquaculture in accordance with the Fifth National Development Plan.

The structure of the Department of Fisheries has been analysed with a view of finding out how it facilitates the provision of services for the promotion of aquaculture. This study observed that the current structure of the Department is biased in favour of capture fisheries due to historical reasons. Emphasis on the development of aquaculture is a new concept that has arisen out of the realisation that capture fisheries are limited. This realisation is also coming at a time when resources for expanding the establishment of the Department of Fisheries are not available due to economic and budgetary problems experienced. Consequently, the structure of the Department of
Fisheries remains small and unable to facilitate expansion in support of aquaculture development. Currently the structure of the Department of Fisheries is mainly designed to facilitate administration of the sector with emphasis on the capture fisheries. Proposals as to how the structure of the department can be reorganised to facilitate development of aquaculture are made.

Training and academic programmes offered in different institutions in the country were also assessed by Hassan (2004) and this study has updated the information available by interviewing aquaculture trainers in institutions providing training in fish farming in relation to the development of aquaculture. This study observed that there is a strong bias particularly for programmes offered in the Department of Fisheries towards management of the capture fisheries. Suggestions as to how training programmes can be improved to facilitate expansion of the aquaculture sector are suggested by the author.

An appraisal of the trained manpower resources of the fisheries sector was undertaken also with a view to assess requirements for aquaculture development. Several studies undertaken in the past such as by IPS (2002) Hasan (2004) were used to assess the human resources capacity of the Department of Fisheries, both for capture fisheries and aquaculture. It is clear that there is a critical shortage of manpower specialized in areas of capture fisheries and aquaculture in the country. In addition the Government has taken drastic measures aimed at reducing the size of the public sector. These measures have constrained expansion and development of aquaculture. Suggestions as to how the sector can still expand and develop in this environment are proposed as part of the recommendations.

Based on the available literature, an assessment of social and gender aspects in aquaculture were also conducted with a view of determining appropriate interventions. As expected, males dominate the aquaculture production as owners of fish farming enterprises and as workers. In addition, formal interventions to develop the sector, like extension programmes of the Department of Fisheries and training programmes, seem not to be addressing the problems of gender bias. Approaches that could be used to address gender, HIV and other socio-economic issues in fisheries and aquaculture are suggested.

The study also observes that there is high demand for fish in the country. This has been attributed mainly to the increase in the population. As a result the fish from fish farming is easily marketed. However, as fish farming develops, it will be appropriate to put in place strategies to support marketing of farmed fish. These measures and concepts are included in the Fifth National Development Plan of 2006.

Finally the study comes up with a series of recommendations that need to be implemented for the development of aquaculture in Zambia. The recommendations made, are not confined to the activities of any specific project but should be considered for implementation by the Ministry of Agriculture as strategies for developing aquaculture. One of the key observations made is that aquaculture could be a
dependable food production system in households of rural areas even though Zambia does not have a strong aquaculture tradition. Donor funded projects implemented in the past have made an impact by popularizing fish farming as an acceptable food production and income earning strategy. Aquaculture can be significantly expanded through commercialisation and involvement of private sector, particularly local financial institutions. Marketing and out-grower schemes need to be designed and implemented in order to facilitate rapid expansion of fish farming. Implementation of studies for the establishment of aquaculture out-grower schemes and financing arrangements to the sector, as highlighted by the Fifth National Development Plan and the Aquaculture Strategy, are further suggested.
# TABLE OF CONTENTS

**EXECUTIVE SUMMARY**  
IV

1 **OVERVIEW**  
11

2 **AQUACULTURE IN ZAMBIA**  
17

2.1 **Historical Development**  
17

2.2 **Aquaculture Practices**  
18
  2.2.1 Non-Commercial Fish Farming  
  2.2.2 Commercial Fish Farming  
20

2.3 **Species for Aquaculture**  
23

2.4 **Aquaculture Development Constraints**  
24

2.5 **Potential for Aquaculture Development in Zambia**  
26

3 **PARTICIPANTS IN ZAMBIA’S AQUACULTURE**  
27

3.1 **The Establishment of the Department of Fisheries**  
27
  3.1.2 Organisational Structure of 1992  
  3.1.3 Organisational Structure of 1997  
  3.1.4 Structure of 2003  
29

3.2 **Aquaculture Stations**  
30

3.3 **Provision of Aquaculture Extension**  
31
  3.3.1 First Phase of Extension Services 1950 - 1980  
  3.3.2 Technical Assistance Development Phase (1980-1995)  
  3.3.3 The Agriculture Sector Investment Programme (1996 -2002)  
32

3.4 **Aquaculture Research**  
33
  3.4.1 Initial Aquaculture Research  
  3.4.2 Aquaculture Research of the 1980s  
  3.4.3 National Aquaculture Research and Development Centre  
34

3.5 **Fisheries Training**  
35
  3.5.1 University of Zambia (UNZA) www.unza.zm  
  3.5.2 Copper-belt University (CU) www.edu.zm  
  3.5.3 Mulungushi University www.moe.gov.zm  
  3.5.4 Natural Resources Development College (NRDC) www.african college.edu.zm  
36

3.6 **Fisheries Training Centres of the Department of Fisheries**  
37
  3.6.1 Kasaka Fisheries Training Centre  
  3.6.2 Mwekera Fisheries Training Centre  
38

3.7 **The National Aquaculture Association of Zambia**  
39

3.8 **Fish Farmers**  
39
3.8.1 Small Scale Fish Farmers 40
3.8.2 Commercial Fish Farming 40

3.9 Aqua Feed Manufacturers 41

4 THE REGULATORY FRAMEWORK AND POLICIES 42

4.1 The Fisheries Conservation Ordinance (1962) 42
4.2 The Fisheries Act (1974) 43
4.3 Proposed Fishery Legislation (1998) 44
4.4 Fisheries Amendment Act (2007) 45

5 DEVELOPMENT PLANS AND FISHERIES 46

5.1 General 46
5.2 Pre-Independence Development Plan 47
5.3 The First National Development Plan 47
5.4 The Second National Development Plan 47
5.5 The Third National Development Plan 47
5.6 The Interim National Development Plan 48
5.7 The Fourth National Development Plan 48
5.8 Fisheries Development Programme 49
5.9 The Fifteen Years Strategic Fisheries Development Plan 50
5.10 The Fifth National Development Plan and Vision 2030 (www.unda.org.zm) 51
5.10.1 Aquaculture Development 51
5.10.2 Capture Fisheries Management and Development 52
5.10.3 Fish processing and Marketing 53
5.10.4 Fisheries Training 53
5.11 The National Aquaculture Strategy 2006 54
5.12 Draft National Fisheries Policy 54

6 AQUACULTURE DEVELOPMENT PROJECTS 56

6.1 The Fish Culture Development Project (1980-1989) 56
6.2 The (ALCOM) Programme (1985 – 1996) 57
6.3 The Fish Culture Adaptive Research Project (1982 – 1995) 57
6.4 ICARA I AND ICARA II (1982-1987)

6.5 The Food Production and Income Generation through Fish Ponds in Zambia Project (1992 - 1996)

6.6 The Fish Hatchery Project (1990 – 95)

6.7 Japanese Grant Aid to the National Aquaculture Centre (1996 – 1998)

6.8 ZAP/RAP (1996 to date) www.usemb.org.zm

6.9 Smallholder Aquaculture Programme SHAP (1998 - 2001)

6.10 National Aquaculture Research and Development Centre (1996 - To Date)


6.12 The Farmer Based Aquaculture Training (FAT) 2006 - 2008

7 THE DRAFT NATIONAL FISHERIES POLICY

7.1 Policy Objectives for Aquaculture Development

7.2 Policy Strategies
   7.2.1 The Role of the Central Government:
   7.2.2 The Role of Local Governments Provincial and District Levels
   7.2.3 The Role of Civil Society

8 NEEDS AND PRIORITIES FOR FUTURE NATIONAL DEVELOPMENT AGENDA

8.1 Institutional Arrangements for Aquaculture Development

8.2 Participation of Local Financial Institutions in Aquaculture Development

8.3 Aquaculture Extension System

8.4 Specialisation in Aquaculture

8.5 Strengthening Aquaculture Research

8.6 Strengthening Aquaculture Training Institutions

8.7 Strengthening Linkages and Cooperation

8.8 Aquaculture and the Environment

8.9 Preparation of the National Fisheries Policy Document

REFERENCES
1 Overview

Zambia is a medium sized African country with a total surface area of 752,614 km². The climate is subtropical and has three seasons: a cool dry period from May to August when temperatures range from 14 to 21°C; a hot dry season from August to October and a rainy season from November to April when temperatures range from 27 to 38°C (Archer 1971). There are three distinct agro-ecological regions defined by precipitation: Region I has less than 700mm of rainfall and includes southern parts of Eastern, Lusaka, Southern and Western provinces. Region II receives between 700mm to 1200 mm rainfall and includes northern parts of Eastern, Lusaka, Central and Western provinces. Region III receives more than 1200mm annually and covers parts of Northern, Luapula, Copperbelt, and North-western and a small part of Western provinces.

Aquaculture is practiced in all the regions where water is not a serious constraint. Kapetsky (1994) classified Zambia as a country that has good conditions for fish farming. This assessment was based on soil conditions, availability of water and temperature. Availability of fish farming inputs and provision of extension services seem to be the major limiting factors to the expansion of fish farming in most parts of the country.

Zambia has three main river systems: the Zambezi; Chambeshi (Congo) and Tanganyika (Lufubu) River basins. The Chambeshi basin shown in Figure 3 is the most important fishery area and consists of the Chambeshi River itself; the Bangweulu Lake and Swamps Complex; the Luapula River; and Lake Mweru. The Zambezi basin catchment area is the largest in terms of size and is also the most important economic zone and consists of the Luangwa River; the Lukanga Swamps, the Kafue River in the central region and the Upper, Middle and Lower Zambezi
(see Figure 2) fishery areas. The Lake Tanganyika basin in Zambia is the smallest and consists of a fish fauna with Nilotic affinities. It is the smallest in terms of size, but is probably the most important in terms of fish production and fish fauna. The Mweru -wa Ntipa catchment could be considered to be another basin since it is an internal drainage system with no outlet. Geologically it has connections to the Mweru Luapula system.

Owing to low population density, Zambia has until recently depended on its natural fisheries for its supply of fish. However, increasing urbanisation and overall population growth has required recognition of the importance of farmed fish. Fisheries of Zambia may be classified into three categories: major fisheries; minor fisheries; and fisheries of small water bodies.

Major fisheries are: Bangweulu Lakes and Swamps Complex; Kafue Flood Plains; Lake Kariba; Lukanga Swamps; Mweru-Luapula; Lake Mweru wa Ntipa; Lake Tanganyika; and the Upper Zambezi Floodplain, (see Figure 3). Minor fisheries include: Lake Itezhi-tezhi; Lake Lusiwashi; and the Lower Zambezi.

Fisheries of small water bodies include several small rivers; seasonal streams and small reservoirs scattered throughout the country. Aquaculture output is considered under this category.

Annual fishery production ranges between 65,000 to 70,000 tonnes. Annual aquaculture production in 2008 is estimated at 6,960 tonnes (Draft Aquaculture Development Plan 2009). The fisheries sector contributes significantly to employment, income and food production. However, the natural fishery areas have in recent years been either fully or in most cases even been overexploited, making it difficult to significantly increase fish production to meet the demands of increasing population -now estimated at 120,000 tonnes per year.

Figure 2: Provincial Map of Zambia CSO Provincial Statistics 2006
The Zambian population is currently estimated at 12.8 million with an annual growth rate of 2.9% (CSO Monthly Digest of Statistics, January 2009). The country is highly urbanised by African standards, mainly because of relatively large urban copper mining settlements and related infrastructures.
Table 1: Population Distribution by Province 2000-2009

<table>
<thead>
<tr>
<th>Province</th>
<th>Area</th>
<th>2000</th>
<th>2004</th>
<th>2008</th>
<th>2009</th>
<th>Density</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central</td>
<td>94,394</td>
<td>1,012,257</td>
<td>1,141,256</td>
<td>1,301,776</td>
<td>1,343,835</td>
<td>14.2</td>
<td>10.5</td>
</tr>
<tr>
<td>Copperbelt</td>
<td>31,328</td>
<td>1,581,221</td>
<td>1,767,165</td>
<td>1,980,824</td>
<td>2,034,012</td>
<td>64.9</td>
<td>15.8</td>
</tr>
<tr>
<td>Eastern</td>
<td>69,106</td>
<td>1,306,173</td>
<td>1,482,290</td>
<td>1,684,910</td>
<td>1,740,180</td>
<td>25.2</td>
<td>13.6</td>
</tr>
<tr>
<td>Luapula</td>
<td>50,567</td>
<td>775,353</td>
<td>873,969</td>
<td>997,579</td>
<td>1,030,572</td>
<td>20.4</td>
<td>8.0</td>
</tr>
<tr>
<td>Lusaka</td>
<td>21,896</td>
<td>1,391,329</td>
<td>1,538,000</td>
<td>1,697,730</td>
<td>1,733,830</td>
<td>79.2</td>
<td>13.5</td>
</tr>
<tr>
<td>Northern</td>
<td>147,826</td>
<td>1,258,696</td>
<td>1,401,340</td>
<td>1,577,310</td>
<td>1,619,980</td>
<td>11.0</td>
<td>12.6</td>
</tr>
<tr>
<td>Northwestern</td>
<td>125,826</td>
<td>583,350</td>
<td>660,322</td>
<td>756,261</td>
<td>781,800</td>
<td>6.2</td>
<td>6.1</td>
</tr>
<tr>
<td>Southern</td>
<td>85,283</td>
<td>1,212,124</td>
<td>1,362,382</td>
<td>1,545,880</td>
<td>1,592,864</td>
<td>25.2</td>
<td>13.6</td>
</tr>
<tr>
<td>Western</td>
<td>126,386</td>
<td>765,088</td>
<td>839,757</td>
<td>937,419</td>
<td>963,107</td>
<td>7.6</td>
<td>7.5</td>
</tr>
<tr>
<td>Zambia</td>
<td>752,612</td>
<td>9,885,591</td>
<td>11,066,48</td>
<td>12,479,68</td>
<td>12,840,18</td>
<td>17.1</td>
<td>100.0</td>
</tr>
</tbody>
</table>


Highest population densities are therefore found in the Copperbelt, Lusaka, Eastern and Southern provinces. Industry and commercial farming activities are also located close to mining settlements and the railway line corridor from south to the north in Central, Copperbelt, Lusaka and Southern Provinces. The Eastern province has no commercial fishery. It is regarded as the ‘aquaculture province’ because aquaculture is the only possible source of fish in this region. Thus, Eastern, Copperbelt, Lusaka and Southern provinces represent the best markets for farmed fish.

Even though Zambia is landlocked, fisheries are very important in the national economy because of its relative abundance of water resources. Fishing activities contribute significantly to employment and food production. Overall, fisheries contribute about 3 percent of the Gross Domestic Product. It is estimated that over three hundred thousand persons directly or indirectly obtain part of their income from the fisheries sector.

Table 2: Estimated Annual Fishery Output, Metric Tonnes

<table>
<thead>
<tr>
<th>Fishery/Year</th>
<th>2000</th>
<th>2002</th>
<th>2004</th>
<th>2006</th>
<th>2008</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangweulu Swamps</td>
<td>13,687</td>
<td>14,370</td>
<td>13,903</td>
<td>12,366</td>
<td>16,301</td>
<td>20.53</td>
</tr>
<tr>
<td>Lake Mweru-Luapula</td>
<td>8,836</td>
<td>9,277</td>
<td>8,976</td>
<td>7,983</td>
<td>10,524</td>
<td>13.25</td>
</tr>
<tr>
<td>Lake Mweru-Wantipa</td>
<td>3,016</td>
<td>3,167</td>
<td>3,064</td>
<td>2,725</td>
<td>3,592</td>
<td>4.52</td>
</tr>
<tr>
<td>Lake Tanganyika</td>
<td>13,156</td>
<td>13,813</td>
<td>13,364</td>
<td>11,886</td>
<td>15,668</td>
<td>19.73</td>
</tr>
<tr>
<td>Kafue River</td>
<td>6,131</td>
<td>6,437</td>
<td>6,228</td>
<td>5,539</td>
<td>7,302</td>
<td>9.20</td>
</tr>
<tr>
<td>Lake Kariba</td>
<td>8,863</td>
<td>9,306</td>
<td>9,003</td>
<td>8,008</td>
<td>10,555</td>
<td>13.29</td>
</tr>
<tr>
<td>Lukanga Swamps</td>
<td>1,306</td>
<td>1,371</td>
<td>1,327</td>
<td>1,180</td>
<td>1,556</td>
<td>1.96</td>
</tr>
<tr>
<td>Upper-Zambezi River</td>
<td>6,728</td>
<td>64</td>
<td>6,834</td>
<td>6,079</td>
<td>8,012</td>
<td>10.09</td>
</tr>
<tr>
<td>Lake Lusiwashi</td>
<td>2,139</td>
<td>2,246</td>
<td>2,173</td>
<td>1,933</td>
<td>2,547</td>
<td>3.21</td>
</tr>
<tr>
<td>Lower Zambezi River</td>
<td>588</td>
<td>617</td>
<td>597</td>
<td>531</td>
<td>701</td>
<td>0.88</td>
</tr>
<tr>
<td>Lake Itezhi-tezhi</td>
<td>2,221</td>
<td>2,332</td>
<td>2,256</td>
<td>2,007</td>
<td>2,646</td>
<td>3.33</td>
</tr>
<tr>
<td>Total Fish Catch</td>
<td>66,671</td>
<td>63,000</td>
<td>67,725</td>
<td>60,237</td>
<td>79,404</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: Government of the Republic Of Zambia: Department of Fisheries Statistics

Fish is also a major food item in the diet of Zambia. According to the Central Statistical Office Living Conditions Survey 2006, fish accounts for 29 percent of the animal protein supply. Fish is an especially important source of protein for the low-
income group because of its relative affordability in comparison with other protein sources such as beef, chicken and pork. In parts of the country without other livestock, fish is often the only legitimate\(^1\) source of animal protein available. The consumption of fish in Zambia on a per capita basis has declined from 12.1 kg per capita in the 1970s to current levels of about 6.1 kg per person. Regular catch assessment surveys by the Department of Fisheries indicate that most capture fisheries are over exploited. For this reason, the Government strategy is to increase fish production through aquaculture development. The first development priority in the fisheries component of Fifth National Development Plan (2006) is aquaculture promotion and expansion.

Commercialisation and intensification of aquaculture through cage fish farming is viewed as one of the strategies for increasing output from aquaculture. However, the Draft Aquaculture Plan (2009) cautions against over-emphasis on cage culture development at the expense of small and medium scale pond culture because this may result in bypassing fish demand by the poor and therefore harm the national (food) poverty alleviation objectives of the Fifth National Development Plan. Expansion of aquaculture through commercialisation of operations is a key development priority for the Department of Fisheries.

Table 2 above indicates that fishery resources from lakes, swamps, rivers and flood plains have produced in recent years 65,000 to 70,000 tonnes of fish annually. This represents a contribution of 2 and 3 percent of the annual GDP. Indicators show that the natural fishery areas are either fully exploited or overexploited. It is now more difficult to increase fish production to sustain local demand, estimated at 154,082 tonnes annually, and for export. Furthermore, informed fish farmers believe that annual demand for fish in neighbouring Katanga province of Congo DR alone exceeds one hundred thousand tonnes and offers a large potential export market. Aquaculture is being viewed as having potential for significantly increasing fish production.

\(^1\) In such places, additional sources of protein consist of illegal hunting of small game and caterpillars
Figure 3: Map of Zambia showing major fisheries (e.g., lakes, rivers and swamps), Fisheries research stations and Fish culture centres. IPS (2002)
## AQUACULTURE IN ZAMBIA

### 2.1 Historical Development

Fish farming in Zambia dates back to the 1940s, when the Joint Fisheries Research Organization (JFRO) undertook fish farming trials. In late 1950s, aquaculture development started generating some interest but progress was slow probably because capture fisheries provided a cheap source of fish. By 1966, there were 1,321 ponds recorded with a total area of 100 hectares producing approximately 88 metric tonnes (MT) in 1967 and by 1985 pond production had increased to 750 MT. Of this 86 MT (11.5%) were produced by small-scale rural fish farmers, 94 MT (12.5%) by Government fish culture stations and 570 MT (76.0%) by commercial farmers (Maguswi 1994). After this initial development, there was a rapid decline probably due to decreased extension services and partly because of reduced commercial incentives to increase production due to the system of price controls introduced by government on food items in the post 1968 economic reforms. In addition, aquaculture development programmes were mainly targeting small-scale farmers, a trend that has continued to the present.

The aquaculture industry is now more diversified than it was at independence in 1964. In addition to stocking fish in conservation reservoirs and ponds, fish culture employs earthen ponds, tanks and cages. Average pond size per farmer among small scale farmers has remarkably reduced from 400 m$^2$ in the eighties to 246 m$^2$ today. This is partially because of emphasis on rural aquaculture through household subsistence ponds rarely exceeding 100 m$^2$ each. There are now 6,460 small-scale farmers with 13,900 fish ponds covering 342 hectares of water producing about 1.2 and 1.6 MT per ha per year (DoF Statistics 2007).

Commercial aquaculture (i.e. those fish farms which are working on a profit/loss basis as commercial businesses) is concentrated among 17 farmers working on 431 fishponds on a total area of 395 ha producing on average 7 MT per hectare per year. In addition, nine of the registered commercial farmers produce fish from 56 cages in the Kariba and have capacity to produce 2,600 tonnes in 8,000 m$^3$ of water. Total fish production from aquaculture is estimated at 6,960 tonnes valued at US $15 million per annum. There is an increasing concentration of fish production among a small number of large scale operators. However, production is still limited despite it only contributing 9 percent to national fish consumption. Overall, fish farming still accounts for less than 1 per cent of the GDP.

The predominant form of labour participation in the fish farming sector is informal. Out of the 5,232 persons identified as employed in fish farming in 2004, 90 percent were in the informal sector. The predominance of informal fish farming activities is another challenge facing the sector. Only 10 percent of farmers pay taxes and can access external investment resources as they operate from titled land. It is desirable to increase the size of this class of fish farmers.

The dominance of informal fish farmers is mainly due to the manner in which aquaculture was introduced and as explained in section 3.3 and 6 of this document.
aquaculture development has been facilitated by the Government programmes through the Department of Fisheries and Donor funded project with a main objective of improving food security for the poor. Communities that were targeted live in traditional lands. Currently Government is implementing land reforms with a view to bring most of the traditional land into the commercial sector. This is a political problem since land is the only asset the most rural communities own.

2.2 Aquaculture Practices

The most common type of aquaculture in Zambia is fish farming based mostly on species from the Cichlid family namely, *Oreochromis andersonii* (64%), *Tilapia rendalli* (20%) *Oreochromis niloticus* (5.2 %) *Oreochromis macrochir* (5%), and to a lesser extent, but in order of significance Carp, crayfish (red claw, maron and yabbies), and catfish <1%). After several years of adaptive research, fish farming in Zambia has attained a high level of diversity ranging from extensive to intensive practices; and from multi-species to mono species culture (Mudenda, 2005). Currently fish farming systems practiced in Zambia include: extensive and non-commercial fish farming; semi-intensive; and intensive aquaculture practices.

2.2.1 Non-Commercial Fish Farming

The non-commercial fish farming systems are the most prevalent forms of aquaculture and have been encouraged by the Government for the purposes of strengthening food security in areas with communal water bodies and characterised by protein food deficiency due to lack of livestock rearing practices. The stocking of fish in existing impoundments, mainly community small water conservation dams is one such approach. In this practice, one or more species may be added to the water body. In order to be effective, species reared should be able to reproduce naturally when introduced or trans-located to another water body. Levels of management are generally low. In few cases (often involving a public institution) there is supplementary feeding using mill sweepings (Mudenda, personal observations, 2009). In general, there is usually no regular feeding or fertilisation as this system relies on natural reservoir fish food production.
For this type of aquaculture there is very little control and regulation of environmental conditions compared to other types of aquaculture. Extensive fish culture is being carried out in private and communal water storage dams throughout the country, particularly in drier parts such as Southern, and Eastern provinces where many reservoirs constructed to mitigate drought conditions have been stocked with cultured juvenile fish. The major drawback for extensive aquaculture system is more evident in locations where attempts to establish community reservoir management institutions to manage fish resources have been made. These institutions have however no legal powers and do not hold regular elections and have unclear accountability rules.

Community small water body management institutions have no legal ownership of the water body. Communities manage the water body on behalf of the ‘government’. They rely on moral force and persuasion of traditional norms and government authority. They enforce fishing bans from 1<sup>st</sup> December to 28<sup>th</sup> February every year even though the statutory fishing ban only applies to commercial fishery areas. In some situations, lack of fishing gear makes communities to resort to the use of illegal fishing gear, often mosquito nets, thereby removing undersized fish altogether and necessitating regular stocking by the Department of Fisheries. In better managed cases, anglers pay in cash by weight for the fish caught. Extensive aquaculture is probably the least successful in the prevailing situation. Decentralization of the fisheries management system as proposed in the Draft Fisheries Act and the National Fisheries Policy Described Draft may offer some solutions to problems relating to management of small water bodies.
Other non-commercial aquaculture systems involve stocking of fish in one or more small household ponds not exceeding 100 m² each. The purpose of these ponds is to support farming household by improving food security. Pond fertilisation is achieved through composting and construction of a crib to fertilise the pond. Typically, the cribs are usually empty and generally not adequate for the purpose for which they are maintained. Stocking is generally one fish per square metre and juveniles for stocking are either obtained from neighbours or neighbourhood government fish farm. Intermittent harvesting is common and sales are limited to neighbours. Farmers with several such ponds may barter the harvest for grain or other food, while others exchange for agricultural labour time during peak labour season, which coincides with periods that rural households are also short of food. This system has been popularised through the Rural Aquaculture Project paid by the United States Agency for International Development (USAID) (http://www.usaid.gov/zm/index.htm; http://zambia.usembassy.gov/zambia/rapp.html). It is responsible for the increase in numbers of fish farming households in recent years and also an avenue for recruiting small scale commercial fish farmers.

### 2.2.2 Commercial Fish Farming

Commercial fish farming is represented by semi-intensive fish culture. This system is more capital and labour intensive than extensive cultures. It involves construction of fishponds often exceeding 100 m² but less than 400 m². It involves greater control of environmental pond parameters through application of compost, organic manure or chemical fertilizers. In most parts of the country, supplementary feeding is done by using agricultural by-products such as maize bran, rice bran, sunflower cake, brewery wastes, mill sweepings and chicken litter. Fertilisation relying on organic manure is more common as the high cost of inorganic fertilisers is a constraint to many such farmers.

Ponds are stocked with one or more species selected for their favourable characteristics that may include: availability, rapid growth, individual size, range of diets and size at first breeding etc. Such farmers often obtain fingerlings from outside the farm, either a Government fish farm or a private hatchery. It is also a common practice among such farmers to restock undersized fish during harvest. Stocking follows the recommended three fish per square metre. As a result of higher capital and labour inputs, yields are higher and conducive for periodic harvesting. Semi-intensive fish farming is carried out in all provinces by small-scale fish farmers, private and public institutions such as: schools, colleges, National Service Centres and the Prison Services.

Partial harvesting is a common practice because of the lack of cold storage facilities. Fish is sold by the pondside and through neighbourhood food stores. Among the farmers with larger ponds and therefore with more significant production, it is smaller fish that are sold by the pond (in cash or in kind), and the larger fish are reserved for cash sales through food stores, neighbourhood boarding schools; teachers and rural health centre workers. In some situations, fish is exchanged in kind for grains (maize and sorghum) and also for labour.
One problem facing small scale pond owners is access to suitable sites. Many of them reside on communal land. Land used for aquaculture is often the same as that reserved for kitchen gardens. Such land is often located further from residential areas and therefore theft from fishponds is a very big problem. A related problem is predation by otters and other wild animals. Other than, drought, these are the more common reasons for pond abandonment among small scale farmers.

Land ownership rights are also a problem for development of aquaculture in customary land tenure. Succession rules sometimes preclude spouses and children. This is often a problem in the event of death of a landowner. In matrilineal society land ownership is vested in female relatives and unless the wife has a pond of her own, it is difficult for the husband to own a pond. In one instance seen by the author, a man was forced to abandon his investments in land (dwelling house and fishponds) upon the death of this wife. Similarly, in patrilineal societies, exclusive land ownership by males also makes it difficult for women to have access to land for aquaculture, except through a male relative.

Commercial fish culture tends to intensively rely on artificial feeding practices, and greater investments in capital and labour. Intensive land based systems entail construction of costly earthen ponds, concrete or plastic water holding facilities. Fish cages moored in larger water bodies, streams or other flowing water environments can also fall into this category.

Stocking of aquaculture facilities: ponds; tanks; raceways etc with single or multi-species is at high density. Mono-sex or sex manipulated (sex reversed,) fish are stocked to further improve yields. Production of fry and fingerings is often carried out in separate facilities with naturally or by induced spawning. A few farmers specialize in fingerling production for sale to grow-out farmers using induced spawning.

Intensive pond culture operations are confined to a few large scale operators such as Kafue fisheries, near Lusaka (http://www.mbendi.com/orgs/co9q.htm). This farm, being the largest in the country, has 96 fishponds on 72 hectares integrating pigs and employing paddlewheels to aerate the ponds. Others, such as Sobe Farm in Ndola rural has 13 ha of fishponds for producing table fish in addition to a number of tanks for specialized culture of ornamental cichlids from Lake Tanganyika for export.

A few other fish farmers practice intensive fish culture. A number of farmers in Lusaka are using imported fabricated recirculation systems that produce between 25 and 50 tons per cycle. Five such tanks were identified. There used to be an intensive fish farm at the Nakambala Sugar Estates in Mazabuka where Oreochromis niloticus, was introduced and cultured in recirculation tanks for feeding seasonal migrant workers. Production ceased in 1993 when the Plantation was privatised as the new owners decided to concentrate on the core business of the enterprise (cane sugar production).

On Lake Kariba, intensive cage fish farming was introduced in the late 1990s using the Nile Tilapia, Oreochromis niloticus, following the example set by the British Corporation Lake Harvest (http://www.lakeharvest.com/index.htm) on the Zimbabwe side of the

---

2 This point is presented more detail below in the section on gender relations in aquaculture
Lake. Currently, there are about 56 cages on Lake Kariba and Transcontinental Limited is one of the earlier establishments and has 6 cages. Chuundu Aquaculture (http://www.mbendi.com/orgs/cpqc.htm) and Great Lakes Products are more recent establishments and have the largest number of cages with 16 each, while other farms have only two or three cages each. However growth of cage fish farming has been relatively low mainly due to unresolved environmental concerns particularly in the 1990s when cage fish farming was introduced in Lake Kariba. The high cost of formulated feeds is one of the entry barriers to cage culture. On-farm fish feed formulation is not yet a common practice, due to lack of know-how among farmers.
### 2.3 Species for Aquaculture

One of the constraints to the development of aquaculture in Zambia is that the number of species available for fish farming are restricted, as highlighted above. Most aquaculture operations in Zambia rely on culture of three indigenous fishes, *Oreochromis andersonii*, *Oreochromis macrochir*, and *Tilapia rendalli*. The species of fish that are farmed in Zambia are very few. These species are also very abundant in the natural fisheries. The other problem is that farmed fish by small scale farmers are generally smaller than wild caught fish and therefore sell poorly in markets in relation to wildfish which is larger and is generally preferred by consumers. A comparison made by Mudenda, C.G. (2004) of returns to fishing and aquaculture on Lake Kariba indicates that returns to fish farming are relatively lower than those associated with fishing. This therefore, tends to make fish farming less attractive, where natural, wild caught fish are still common. Exotic fish species such as the common carp, *Cyprinus carpio*, have been introduced in aquaculture principally, to improve productivity.

Garibaldi (1996) listed a total of 262 species used in aquaculture worldwide. The number of species that has been commonly farmed in Zambia is less than ten (see Table 4). Several native fish species, *Labeo altevelis*, *Oreochromis mortimeri* and *Clarias gariepinus* show potential as good species for aquaculture but very little has been undertaken to determine their potential for aquaculture.

Despite all these and other negative effects about fish farming in Zambia, aquaculture is steadily expanding in the country, in all of its nine provinces. This could be attributed to high demand for fish mainly due and rising population as well as the high cost of other protein sources. Furthermore, high cost of imported fish is an incentive for domestic production.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><em>C. carpio</em></td>
<td>100</td>
<td>175</td>
<td>227</td>
<td>275</td>
<td>217</td>
<td>220</td>
<td>220</td>
<td>220</td>
<td>3.16</td>
</tr>
<tr>
<td>Cyprinidae</td>
<td>-</td>
<td>10</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td><em>O. niloticus</em></td>
<td>50</td>
<td>105</td>
<td>165</td>
<td>133</td>
<td>219</td>
<td>220</td>
<td>220</td>
<td>220</td>
<td>30.26</td>
</tr>
<tr>
<td><em>O. macrochir</em></td>
<td>200</td>
<td>350</td>
<td>368</td>
<td>407</td>
<td>207</td>
<td>210</td>
<td>210</td>
<td>418</td>
<td>6.01</td>
</tr>
<tr>
<td><em>O. andersonii</em></td>
<td>1200</td>
<td>2100</td>
<td>2217</td>
<td>2680</td>
<td>2689</td>
<td>2700</td>
<td>2750</td>
<td>2850</td>
<td>40.96</td>
</tr>
<tr>
<td>Oreochromis (=Tilapia) sp</td>
<td>600</td>
<td>1155</td>
<td>180</td>
<td>200</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td><em>T. rendalli</em></td>
<td>300</td>
<td>700</td>
<td>840</td>
<td>1010</td>
<td>827</td>
<td>830</td>
<td>840</td>
<td>1322.4</td>
<td>19.01</td>
</tr>
<tr>
<td><em>C. gariepinus</em></td>
<td>20</td>
<td>70</td>
<td>74</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Procamarus clarkii</td>
<td>-</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>42</td>
<td>0.60</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2470</td>
<td>4655</td>
<td>4081</td>
<td>4718</td>
<td>4159</td>
<td>418</td>
<td>4240</td>
<td>6,957</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Source: Estimates of Aquaculture Production 2006
Most fish species that are used in aquaculture are collected from the wild and bred in captivity. The fish are reared in artificial ponds for the production of fingerlings that are stocked in fishponds. From time to time, it is important to cross the farmed strains, with the wild ones so as to reduce inbreeding and to increase pond productivity.

*Oreochromis andersonii* (the Three Spot Bream) is the most commonly farmed species in Zambia, particularly in the commercial sector. Table 4 above shows that over sixty percent of aquaculture production is *Oreochromis andersonii*. Other Cichlid species such as *Oreochromis macrochir* (the Green Headed Bream) and *Tilapia rendalli* (the Red Breasted Bream) are also farmed. *Oreochromis andersonii* has demonstrated to have highest growth rate among the farmed species even though it does not grow to big sizes in comparison to the *Oreochromis macrochir*. Studies have so far revealed that *Tilapia rendallii* does better in extensive farming systems, but grows much more slowly than *Oreochromis andersonii*. Furthermore, the monoculture of *andersonni* is superior to polyculture with other indigenous species.

In order to improve the general performance of aquaculture, exotic species were introduced. The Common Carp (*Cyprinus carpio*) and the Nile Tilapia, (*Oreochromis niloticus*) are some of the exotic species that have been successfully introduced for aquaculture purposes. In addition, Crayfish (red claw, yabbies and maron) are also farmed in Livingstone (Grubb 1994) and Kafue and have a limited but growing local market among leading hotels and restaurants.

### 2.4 Aquaculture Development Constraints

Studies by the Institute for Policy Studies in 2002, leading to the formulation of the long term plan for the fisheries sector, observed that even though aquaculture seems to have expanded in the country over the years, making Zambia one of the leading countries in fish farming in Southern Africa and in the SADC region in particular—there were several factors that appear to impede aquaculture development. The study by the IPS in 2002 lists the following as impediments for aquaculture development:

1. Poor institutional arrangement for the fisheries sector particularly for aquaculture;
2. Critical shortage of experts in various areas of aquaculture to design research and development programmes and to oversee their implementation;
3. Shortage of extensionists in fish farming to provide technical services to fish farmers
4. Shortage of financial resources to implement even the most basic research and development programmes.
5. Insufficient knowledge about the sector leading to inappropriate design of aquaculture research and development projects
6. Non availability of concrete policy guidelines for the development of the fisheries sector; and
7. Non availability of legal framework conducive to the development of aquaculture.

Most of these impediments may be still relevant even though some initiatives have been undertaken by the Department of Fisheries to address them.
The following are some of the policy constraints for the development of aquaculture in Zambia that need to be addressed in the implementation of future development programmes.

i) Lack of a strong local aquaculture tradition in all parts of the country

ii) Insufficient extension services to provide advice to potential fish farmers and other investors in aquaculture;

iii) Lack of resources, aquaculture infrastructure, for institutions involved in aquaculture training

iv) Shortage and erratic supply of funds to support aquaculture research;

v) Poor livestock rearing traditions particularly in most high rainfall areas of the country to facilitate profitable integrated fish farming;

vi) Shortage of extension and advisory services in aquaculture to facilitate dissemination of aquaculture skills to potential fish farmers

vii) Poor follow up of aquaculture development programmes and projects resulting in decline of aquaculture activities at the end of aquaculture projects in given areas;

ix) Low priority accorded to fisheries and aquaculture development programmes in national development programmes

x) Poor implementation of development plans and aquaculture development programmes

xi) Too much emphasis accorded to maize farming at the expense of aquaculture and livestock and other farming systems in development programmes

xii) Inadequate funding for the Aquaculture Research division in the Department of Fisheries and the National Aquaculture Research and Development Centre to do what?

xiii) Lack of knowledge by many operators regarding the new aquaculture regulation;

xiv) Non active participation of financial institution in aquaculture promotion

xv) Poor institutional arrangements for the identification of aquaculture research topics; and

xvi) Shortage of specialists in different areas of aquaculture to design aquaculture development programmes and oversee their implementation

xvii) Expensive fish feeds used in cage fish farming

Supply of fish fingerlings to farmers does not seem to be a major constraint for two reasons. Chirundu Bream Fish Farm in Siavonga claims to have the capacity to meet the country’s fingerlings demand. Their current problems are in setting up a distribution network so that fingerlings can be made available easily to farmers when they need. The main market for the fingerlings produced by Chirundu Bream Fish Farm are the cage farmers in the Siavonga area of Lake Kariba.

Another reason why fingerling supply is not commonly seen as a major problem is that the package and species recommended for farming are designed in such a way that fingerling supply is addressed. The *Oreochromis andersonii* used in integrated aquaculture is a prolific breeder such that any farmer, even at small scale level, can easily produce fingerlings.
8.2 Potential for Aquaculture Development in Zambia

There is however potential to facilitate a rapid development and expansion of fish farming in Zambia that needs to be exploited. Some of the strengths for fish culture development in Zambia are:

i) Acceptance by local communities that aquaculture is an acceptable food production system;
ii) High preference for fish among the local population or good fish eating habits among the local people;
iii) Abundance of water, perennial streams, particularly in high rainfall areas that can be used for aquaculture;
iv) Good livestock rearing traditions particularly in Eastern Southern and Western Provinces making integrated fish farming easy and profitable;
v) Good soils and climatic conditions suitable for fish farming in most parts of the country;
vii) A farming community keen to take up and integrate aquaculture in their food production processes;
viii) The realisation by Government and the public that capacity from natural fisheries is limited and that aquaculture can play a critical role in meeting the shortfall in fish supply;
ix) History of aquaculture among institutions involved in the provision of services to the farming community particularly the Department of Fisheries;
x) Availability of an aquaculture extension service and an Agriculture Extension Service covering all parts of the country though aquaculture extension is not as extensive as that of the Department of Agriculture;
x) Availability of an Aquaculture Research division in the Department of Fisheries with appropriate infrastructure including a National Aquaculture Research and Development Centre;
xii) Availability of training Programmes in Aquaculture at different levels to cater for different stake-holders;
xiii) Availability of training manuals and extension materials to cater for needs of farmers and extension agents;
xiv) Availability of provisions in the Fisheries Amendment Act of 2007 and the Environmental Protection and the Pollution control Act of 1990 for the management of Aquaculture;
xv) Availability of proven methods that can be adopted for engaging in economically viable aquaculture;
xvi) The interest shown by cooperating partners to support aquaculture development in the country;

However the development of aquaculture in Zambia is not commensurate with the potential for the capacity of the sub sector. Aquaculture output is estimated at 5,000 to 8,000 tonnes annually approximately 10 % of the output from capture fisheries.
3 PARTICIPANTS IN ZAMBIA’S AQUACULTURE

The Department of Fisheries is the main player in Zambia’s aquaculture particularly in the provision of extension services and training. In recent years, there have been policy measures to liberalise the economy and to pronounce the involvement of the private sector in the provision of both the aquaculture research and extension services. However, this has not yet been put into action mainly because of the small size of aquaculture. The Department of Fisheries is still the dominant player in fish farming. Consequently transformations in aquaculture are limited by the ability of the Department to implement programmes in the sector and by the policy framework under which the Department has to execute its mandate. Such an environment is not suitable for the private sector and NGOs to play a catalytic role in the development of fish farming as is demonstrated by past experiences.

In the 1990s a number of tertiary institutions of learning introduced training courses in fisheries and aquaculture. The Department of Fisheries redesigned training strategies in that they were no longer conducting training programmes to suit their specific need of Government institutions. Training programmes were conducted irrespective of the staff requirement of Government institutions that recruited trainees on completion of training programmes. Trainees of Government institutions were also free to join any institution that needs their services. Until then, the fisheries training programmes were designed for the needs of the Government. However, the public sector remains the main employer of fisheries technicians and scientists under the prevailing circumstances.

3.1 The Establishment of the Department of Fisheries

The Department of Fisheries was established in 1974 from a fisheries branch of the Department of Wildlife, Fisheries and National Parks under the Ministry of Lands and Natural Resources. Since then, several changes in the organisational structure of the Department have taken place, which had implications for aquaculture development. Since the establishment of the Department of Fisheries, aquaculture has continued to gain more recognition through establishing additional aquaculture units and stations. Some of the main changes that have taken place in the Department of Fisheries are:

i) Establishment of a Fish Culture Unit in 1974 to oversee implementation of fish farming programmes;

ii) Transfer of the Department of Fisheries in 1982 from the Ministry of Natural Resources to the Ministry of Agriculture;

iii) Reorganisation of the Department of Fisheries in 1992 into three main Divisions: Aquaculture, Fisheries and Training;

iv) Establishment of the Aquaculture Research Unit in 1992 as a component of the Aquaculture Division;
v) Establishment of the National Aquaculture Research and Development Centre (NARDC) in 1995 at Mwekera with Technical Assistance from JICA (http://www.times.co.zm/news/viewnews.cgi?category=8&id=1235203174)

vi) Abolition of the Department of Fisheries in 1997 by the Public Service Reform Programme and reorganisation of the Ministry of Agriculture, Food and Fisheries resulting in placing the Fisheries Research and the Aquaculture Research units in the new Department of Research and Specialist Service and transfer of the Fisheries Management, Aquaculture Extension and the Fisheries Training units to the new Department of Field Services;

vii) Preparation of proposals in 2002 for the re-establishment of the Department of Fisheries; and re-establishment of the Department of Fisheries in 2005.

Over the years, the main tendencies for development of Zambian aquaculture have come from the desire to achieve national food self sufficiency and fish import replacement. It was in 1974 that the Government admitted through the Second National Development plan that Zambia could no longer obtain sufficient fish supplies from her rivers and lakes. In order to reduce on fish imports, additional fish supplies would have to come from better use of existing water bodies for fishing and through established aquaculture facilities. The Government decided to invest in fingerling production for stocking small water bodies with juvenile fish to increase availability of fish resources in rural areas. At the same time, public subvention to fisheries and aquaculture management improved through external assistance. These developments had long term implications for the development of aquaculture, such as establishment of different sections within the Department of Fisheries to handle aquaculture development matters.

The establishment of the Department of Fisheries in 1974 demonstrated that the Government would henceforth attach greater importance to the development of the fisheries sector. In the same year the Fisheries Act was enacted to replace the Fisheries Ordinance of 1962.

At its establishment in 1974, the Department of Fisheries had four divisions: Fisheries Extension and Development; Fisheries Research; Fish Culture and a Fisheries Training. This is the first time when a division specifically assigned to aquaculture development was created. Establishment of a division for aquaculture recognised the potential of fish farming to the development of the fisheries sector.

3.1.2 Organisational Structure of 1992

In 1992 the structure of the Department was re-organised into three major branches: Aquaculture, Fisheries and Fisheries Training. The Aquaculture Branch had two units: Aquaculture Extension and Aquaculture Research. The structure of the Department of Fisheries implemented in 1992 established for the first time a unit devoted to aquaculture research. This structure was changed in 1998 through the Public Service Reform Programme PSRP.
3.1.3 Organisational Structure of 1997

The Reorganization of the Ministry of Agriculture, Food and Fisheries in 1997 to 1998 resulted in the fragmentation of the Department of Fisheries into two branches under two independent Departments of the Ministry namely: Field Services: and Research and Specialist Services. The Fisheries Research and Aquaculture Research units were placed under the Department of Research and Specialist Services and the Fisheries Management and Aquaculture Extension sections were placed under the Department of Field Services. In practice this resulted in placement of fisheries and aquaculture under agriculture. As a result, funding to fisheries and aquaculture activities were reduced in favour of agricultural activities. All of the newly created positions of District Agriculture Co-ordinator (DACO) and Provincial Agriculture Coordinator (PACO), at that time were filled by officials from the former Department of Agriculture. Most fisheries experts interviewed indicated as a result, most fisheries and aquaculture development programmes were negatively affected because the DACOs were not able to allocate funds to programmes they did not full understand and appreciate.

3.1.4 Structure of 2003

As a result of problems experienced in the implementation of the organizational structure developed in 1997 and implemented in 1998, the Ministry of Agriculture and Cooperatives again decided to change its structure. It was proposed again to re-establish the Department of Fisheries in a manner similar to the structure designed in 1992.

The Department of Fisheries as proposed in this 2003 structure is headed by the Director of Fisheries and assisted by the two Deputy Directors, one for Capture Fisheries Management and Development and one for Aquaculture Development. The Capture Fisheries Management and Development consist of two divisions: Fisheries Management; and Fisheries Research. Aquaculture Development composed of Aquaculture Extension and Aquaculture Research. There is also a branch that Coordinates fisheries training within the Department.

Initial reorganisation in 1997 sought to address the high cost of fisheries management by retrenching some staff, realigning extension by optimizing provision of services so that extension workers, for instance, would handle all aspects of farming, whether crops, fisheries and livestock. This however proved to be difficult in practice. The reorganisation suggests an increased recognition of the importance of fisheries and aquaculture.

Some of the reasons for the many changes in the structure of the fisheries institutions are: lack of clear fisheries development policies; weak institutional structure in the Department of Fisheries; and an inadequate legal framework for the management of fisheries and aquaculture in the country. Weakness in the administration of the fisheries sector are well known to stakeholders and measures are being put in place to address them. Since 2007 the Department of Fisheries has been preparing a fisheries policy document and considerable progress has been made. A draft policy document has been prepared. The document needs to be reviewed by many stakeholders (including
fishing and fish farming communities in most parts of the country.) and then submitted to the Government for approval. The Department of Fisheries is currently scouting for resources to facilitate consultations on key issues raised in the draft Fisheries Policy Document.

More recently, in 2008, the Government established a new Ministry of Livestock and Fisheries where the Department of Fisheries is naturally placed but no major changes have been observed such as splitting common services of the former Ministry of Agriculture and Cooperatives such as Agriculture Planning Department and the National Agriculture Information Service. It is expected that additional departments will be set up in soon such as the Department of Livestock.

3.2 Aquaculture Stations

The Department of Fisheries has five aquaculture research stations and fourteen fish farms across the country. In the Central Province the Department has stations at Chalata in Mkushi and in Serenje. In the Eastern Province there are stations in Chipata Chadiza Lundazi Nyanje. In the Northern Province the Department has stations in Misamfu and Isoka and in the Southern Province there is a small station at Kanchele in Kalomo District. There are stations in all provinces that serve as aquaculture demonstration centres.

Table 4: Fisheries Department Fish Farms

<table>
<thead>
<tr>
<th>Province</th>
<th>Fish Farm</th>
<th>Ponds</th>
<th>Average area (are)</th>
<th>Farm Area ha</th>
<th>Comment (wss).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lusaka Central</td>
<td>Chilanga</td>
<td>45</td>
<td>20</td>
<td>21</td>
<td>Dams/canals/yr</td>
</tr>
<tr>
<td></td>
<td>Chalata</td>
<td>10</td>
<td>18</td>
<td>2</td>
<td>Canal/spring/dp</td>
</tr>
<tr>
<td></td>
<td>Serenje</td>
<td>9</td>
<td>6</td>
<td>1.5</td>
<td>Dam/canal/dp</td>
</tr>
<tr>
<td></td>
<td>Solwezi</td>
<td>10</td>
<td>18</td>
<td>2</td>
<td>Stream/canal/yr</td>
</tr>
<tr>
<td></td>
<td>Mwinilunga</td>
<td>10</td>
<td>6.6</td>
<td>1.5</td>
<td>Stream/canal/yr</td>
</tr>
<tr>
<td></td>
<td>Kivuku</td>
<td>7</td>
<td>8</td>
<td>1</td>
<td>Stream/canal/yr</td>
</tr>
<tr>
<td>N/western</td>
<td>Fiyongoli</td>
<td>13</td>
<td>2.3</td>
<td>9.4</td>
<td>Dam/canal/yr</td>
</tr>
<tr>
<td></td>
<td>Mwenda</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>Dam/canal/yr</td>
</tr>
<tr>
<td>Luapula</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copperbelt</td>
<td>Ibenga</td>
<td>6</td>
<td>5</td>
<td>2</td>
<td>Dam/canal/yr</td>
</tr>
<tr>
<td></td>
<td>Mwekera</td>
<td>86</td>
<td>12</td>
<td>11.4</td>
<td>Dam/canal/yr</td>
</tr>
<tr>
<td>Northern</td>
<td>Misamfu</td>
<td>30</td>
<td>4.6</td>
<td>4.5</td>
<td>Stream/canal/yr</td>
</tr>
<tr>
<td></td>
<td>Isoka</td>
<td>7</td>
<td>8.4</td>
<td>0.5</td>
<td>Dam/canal/yr</td>
</tr>
<tr>
<td></td>
<td>Chinsali</td>
<td>5</td>
<td>3</td>
<td>0.16</td>
<td>?/canal/yr</td>
</tr>
<tr>
<td>Southern</td>
<td>Kanchele</td>
<td>10</td>
<td>4</td>
<td>3</td>
<td>Dam/canal/yr</td>
</tr>
<tr>
<td>Eastern</td>
<td>Chadiza</td>
<td>7</td>
<td>5</td>
<td>0.3</td>
<td>Dam/canal/yr</td>
</tr>
<tr>
<td></td>
<td>Chipata</td>
<td>21</td>
<td>50</td>
<td>5.1</td>
<td>Dam/canal/yr</td>
</tr>
<tr>
<td></td>
<td>Lundazi</td>
<td>11</td>
<td>10</td>
<td>1.1</td>
<td>Dam/canal/yr</td>
</tr>
<tr>
<td></td>
<td>Nyanje</td>
<td>10</td>
<td>13</td>
<td>1.3</td>
<td>Dam/canal/yr</td>
</tr>
</tbody>
</table>
The fish farms at Chilanga Mwekera Misamfu and Chipata serve as Aquaculture Research stations. They are also involved in fingerling supply and serve as aquaculture demonstration sites for the rest of the fish farms. A list of Government fish farms and the size of each farm together with species promoted is shown in the table 5 above.

In recent years, a private fish farm, Chirundu Bream farm (http://full-o-fish.com/) has started supplementing Government effort in supplying fish seed. The company now produces and distributes fingerlings to fish farmers.

### 3.3 Provision of Aquaculture Extension

The role of aquaculture extension has been to disseminate fish farming technology and offer support services such as fingerling distribution, to actual and potential fish farmers and to provide adequate and suitable advisory services to the industry through training and demonstrations (Ruch, 1965). Often, extension service tends to impose adoption of standard technical packages with little room for flexibility or modifications to situations obtaining in the target area or community.

One of the prominent strategies used for improving adoption rates in aquaculture techniques, has been through the production of aquaculture extension materials such as: manuals, booklets, flip charts, slides, videos, pictures and posters. Some of the booklets have been translated into local languages so that aquaculture information can be available to a majority of the people (Mudenda et al 2005). A list of pamphlets and documents that have been used to assist in the provision of extension services in aquaculture is indicated below:

1. Seed production of Carp in Zambia (JICA 1997 - limited copies available)
2. Guidelines of basic fish Culture Extension Services in Northern Province (NORAD 1995 - limited copies available)
3. ALCOM Extension pamphlets 1,2 and 3 (ALCOM 1991 - limited copies of translations in Bemba and Nyanja)
4. Manual for fish Farming production units in schools (FAO 1987-limited stocks)
5. Handbook of practical fish Culture for Northern Rhodesia (Game and Fisheries, revised 1965 - not available)
7. The fish and Fisheries of Zambia (FALCON 1965 - available)
8. The Culture of *Tilapia niloticus* (Available at Peace Corps)

Examination of the extension manuals shows that all the manuals were prepared with a view to introduce the practice of fish farming among rural communities. None of the
extension manuals attempt to approach fish farming as a viable business venture. This can be attributed to the fact that fish farming was encouraged by government in provinces and areas that have abundant water resources but do not have major capture fishery areas as a subsistence food production system. Northern and North-western provinces are good example of such an approach.

Methods that have been used to provide extension services in Zambia can be divided into three categories based on the period. The first phase is from the 1950s to 1980 and the second is the period from 1980 to 1995. The third phase is from 1995 to the present (Mwango, et al 2002).

3.3.1 First Phase of Extension Services 1950 - 1980

During the first phase, aquaculture extension centred around the Department of Fisheries and to a large extent, it has influenced the provision of extension services to the sector in that provision of extension services to fish farmers is still centred on the Department of Fisheries.

During this phase, the Department of Fisheries, with resources made available from the Government, provided a leading role in the provision of extension services. Extension officers used non-participatory approaches and fish farmers did not actively participate in problem identification and solving. Extension experts alone, on behalf of fish farmers, designed extension programmes (Mortimer, 1965). Consequently, adoption levels of appropriate technologies were low compared to efforts and resources made available to the sector.

Toward the end of this phase, in the late seventies, the Zambian economy started to experience difficulties as, financial resources made available to the Department of Fisheries did not permit regular visits to fish farmers by extension workers. In most situations, fish farmers were not able to continue farming fish on their own resulting in a decline in aquacultural production. Such a situation could be attributed largely to none commercialisation of the sector.

3.3.2 Technical Assistance Development Phase (1980-1995)

As a result of the deterioration in the economic conditions indicated above Government was not in a position to continue providing extension services in the area of fish farming at the rate that the public were requesting for the services. Donors were therefore called upon to assist and a number of them responded positively. This resulted in the implementation of the donor-funded projects described in Section 6 of this document.

Donor funded projects seem to have operated independently and selected extension strategies that suited them best in the area where they operated. The establishment of the National Aquaculture Research and Development Centre was thus designed among other things to facilitate co-ordination of research and extension programmes in the area of aquaculture.
3.3.3 The Agriculture Sector Investment Programme (1996-2002)

Prior to the implementation of the Agriculture Sector Investment Programme (ASIP), a number of aquaculture projects had started to collaborate with the Extension Branch of the Department of Agriculture in the provision of advisory services to farmers. This may have led to the notion that aquaculture is an integral component of Agriculture.

The ASIP policy was formulated at a time when the Ministry of Agriculture Food and Fisheries had too many projects. It was therefore envisaged that ASIP should establish an environment for the co-ordination and reorganisation of the numerous projects that were being implemented. This among other things resulted in the establishment of a new organisational structure of the Ministry, described above, where both fisheries management and aquaculture extension were merged and placed in the Department of Field Services.

3.4 Aquaculture Research

Aquaculture research in Zambia has largely focused on trying to adopt techniques developed elsewhere to local conditions. In some situations, fish farmers successfully started to use fish farming technologies when trials in research stations were still going on. Most of the research implemented was designed to facilitate adoption of aquaculture as food production system in order to improve food security at household level.

3.4.1 Initial Aquaculture Research

Aquaculture research conducted in the 1950’s was mainly involved with the stocking and monitoring of fish introduced in conservation dams by the Joint Fisheries Research Organisation (JFRO). From 1952 to 1954 a number of conservation dams and fishponds were constructed at Chilanga, 20km south of Lusaka, for aquaculture experiments. At the same time, water conservation and fishponds at Mwekera were renovated and expanded.

In the early years of fish farming, in the fifties, species of fish stocked were Oreochromis macrochir and Tilapia rendalli. Meal sweepings were the main supplementary feed. During this period, from 1958 to 1960, manure and fertilizers were introduced. This yielded fish production rates in experimental ponds to about 3.0 tonnes per hectare per year. Such production rates cultivated considerable interest in fish farming such that by 1965, the number of fishponds in the country reached 1,231 with total hectarage approximately 100 ha (FAO 1978). Fish production from aquaculture reached 88.5 metric tonnes.
In order to stimulate further developments in the sector, experiments aimed at boosting productivity were initiated. Trials carried out at Chilanga between 1974 and 1975 yielded results with fish production reaching 6.6 tonnes per ha per year (Kavelec 1975 Moynarovich 1979). The high yields obtained in these trials were partly as a result of introducing new methods of fish rearing developed in Eastern Europe. The methods included the use of fertilizer, manure, chicken feed, maize sweepings and maize bran as supplementary feed. Other measures implemented were the introduction of mass production of fingerlings at Chilanga during the early 1970s.

Trials for large-scale commercial fish farming were initiated mid to late 1970s. Trials in 1978 showed that large-scale fish farming would be feasible in many parts of the country (L'Heureux, 1985).

Preliminary trials demonstrated that small or large-scale fish farming using indigenous species of fish in combination with manure and locally available ingredients for supplementary feed can be highly productive and profitable. The indigenous species of fish identified during these trials were Oreochromis andersonii, Oreochromis. macrochir, Tilapia. rendalli. Raw materials identified for manufacturing supplementary feed are agricultural waste, food processing waste, trash fish, Lake Tanganyika shrimp, and Kapenta.

### 3.4.2 Aquaculture Research of the 1980s

During the 1980s and 1990s research in aquaculture focused on identifying and testing ideal species and system for monoculture of Tilapia, and mass production of both Tilapia and Carp fingerlings. In an effort to further increase yield rates, a number of trials were carried out during the early 1980s. Between 1981 and 1983, trials on integrated fish farming were conducted using fish-cum pig culture (1981), and fish-cum duck culture (1981-1983). Results demonstrated that combining fish culture with agricultural production and animal husbandry could play a significant and positive role in integrated rural development. In these trials’ pigs, ducks or chickens provide waste matter that can be used as manure and feed inputs for fish. In the 1981 feed trials, food conversion ratio for fish-cum pig culture reached 5:1.

In these trails, the ideal number of pigs was estimated per hectare of fishponds. In the fish-cum duck culture it was noted that Peking ducks offered a better option and were preferred to local (Muskovy) ducks because the former stayed on the water much longer. The ideal stocking rate was estimated hectare of water surface. Fish production from this combination reached 7 tonnes per ha per year.

One important result of the Fish Culture Development Project (1985) was a recommendation for the replacement of polyculture systems with monoculture of O.andersonii. This species was selected for its favourable qualities such as breeding habits, attractiveness to the consumer, growth potential and hardness to handling. The project recommended improved technology for mass production of Oreochromis andersonii fingerlings.
From 1981 when JICA started to support aquaculture programmes at Mwekera focus was placed on mass production of carp seed and their distribution throughout the country (http://www.jica.or.id/english/operations/evaluation/tech_and_grant/project/ex_post/africa/zambia_2002_2.html). In conjunction with seed production, the experts were also involved in experimental production of artificial feed for fry and fingerlings (http://www.times.co.zm/news/viewnews.cgi?category=8&id=1235203174).

### 3.4.3 National Aquaculture Research and Development Centre

In 1994, the Department was in a better position to expand its programmes in the area of aquaculture with the establishment of the NRDC. Initial studies implemented by the centre included fish propagation that included developing techniques for the mass production of fingerlings, fish feed formulations for reducing fish fry mortalities in hatcheries and conducting determinations aimed at assessing the pond environment.

These studies were focused on enhancing fingerling production. During this period, it was realised that expanded provision of extension services were not going to produce results commensurate with effort if fish farms did not have the critical inputs such as fish seed particularly for Carp farming. For this reason, the centre put emphasis on fingerling production research.

Fish feed formulation and pond environment studies were also aimed at enhancing fingerling production. The various fish feed formulated were designed to enhance survival rates of the fry. Pond environment studies placed considerable emphasis on plankton studies and controlling aquatic habitat for improved survival of the fingerlings (Soma, et al 1997, 1999).

The National Aquaculture Research and Development Centre was also tasked to conduct studies on the mass production of fingerlings of a Cyprinid, *Labeo altivelis*. This is a species of fish that has been decimated in the Mweru-Luapula Fishery in Luapula Province. The objective was to introduce fingerlings of this species thereby resuscitating stocks of the species in the wild.

The National Aquaculture Research and Development Centre was also encouraged to develop and improve methods for the culturing of the Crayfish. Due to limited financial resources and manpower available, research on the production of fingerlings of *Labeo altivelis* and farming of the Crayfish could not make meaningful advances. Progress on the implementation of such programmes could have enhanced commercialisation and benefits from aquaculture.

### 3.5 Fisheries Training

Training in fisheries and aquaculture was introduced in University programmes in the 1990s and has been expanding since that time. Currently Zambia has three public
36

Universities: The University of Zambia in Lusaka (http://www.unza.zm/index.php?option=com_frontpage&Itemid=1); the Copper-belt University in Kitwe on the Copper-belt (www.cbu.edu.zm/) and Mulungushi University (http://en.wikipedia.org/wiki/Mulungushi_University). Aquaculture training at University level is offered at the University of Zambia (UNZA) and at Copper-belt University (CBU). Other than the training that is offered by the Department of Fisheries, training in fisheries is a recent introduction in tertiary training institutions of Zambia. The following institutions provide fisheries training outside the Department of Fisheries: The Department of Animal Sciences in the School of Agricultural Sciences of the University of Zambia; The Department of Biological Sciences in the School of Natural Sciences at the University of Zambia; and the Natural Resources Development College. Training in fisheries is also provided by the Department of Fisheries at various stations. In addition, the Department of Fisheries conducts short courses from time to time depending on needs.

3.5.1 University of Zambia (UNZA) www.unza.zm

When it was established in 1966 the University of Zambia did not offer training in fisheries but offered degree programmes in botany and zoology and agriculture. Currently the University of Zambia offers degree programmes in Agriculture, Geography, Biological Sciences and Natural Resources that contain fisheries courses. In the School of Agricultural Sciences, the Animal Science degree offers courses in aquaculture.

The Department of Biological Sciences offers a degree option in ecology including optional courses in fisheries and limnology. On the other hand, the Natural Resources programme offered by the Department of Geography provides options for fisheries related subjects, but not aquaculture.

At postgraduate level, the Department of Biological Sciences offers a Masters in Ecology and Biosystematics, including a degree option where subjects related to fisheries are offered with other natural resources courses.

The School of Agricultural Sciences offers undergraduate and postgraduate degree programmes in different disciplines of agricultural sciences. The undergraduate degree programmes are of 5 years duration and are offered in following five disciplines: Animal Science; Crop Science; Land Management; Agricultural Economics; and Food Science & Technology. Students studying Bachelor of Agricultural Sciences with a major in Animal Sciences have the option of taking aquaculture courses. Two aquaculture related courses are offered in the fourth and these are: Introduction to Aquaculture and Integrated Aquaculture.

An Aquaculture option in Animal Science was introduced in 1994, initially with one aquaculture course. In the year 2000, two additional courses were introduced. Students completing the graduation in Animal Science are eligible to enrol in a Master degree programme in Animal Production with specialization on any of two disciplines a) Animal
Nutrition and b) Animal Breeding. This is a two-year degree programme with one-year course work and one-year research work.

After the completion of 3rd year course work, students are sent to commercial farms for hands-on training in fish/integrated culture. In 5th year, students pursuing a BSc degree in Animal Sciences have the option of pursuing a research project in aquaculture

3.5.2 Copper-belt University (CBU) www.edu.zm

The School of Natural Resources at the Copper-belt University (CBU) has been offering a 4-years degree programme in Forestry Management and in Wood Science & Technology. In 2009 the School of Natural Resources introduced a degree programme in Fisheries and Aquaculture. In August 2003, the School conducted a training needs assessment and noted that the Department of Fisheries had 28 vacant positions for scientists, requiring a minimum educational qualification of a BSc degree, and therefore decided to include a 4-year degree programme in Fisheries and Aquaculture in the development plan of the University. This is the first degree programme devoted to producing graduates specifically in fisheries and aquaculture.

3.5.3 Mulungushi University www.moe.gov.zm

Mulungushi University is a new University situated in Central Zambia in Kabwe. It offers degree programmes in Agricultural Sciences with bias in Land economy and evaluation. There are no aquaculture courses offered at this institution.

3.5.4 Natural Resources Development College (NRDC) www.africancollege.edu.zm

The Natural Resources Development College is a training institute under the Ministry of Agriculture and Cooperatives. It offers a 3-year diploma in the following specialisations: Agriculture with a Major in Crop Science; Agriculture Business Management; Water Engineering; Food and Nutrition; Agricultural Education; and Fisheries.

The Fisheries diploma course offered by NRDC is a broad-based training programme covering subject areas ranging from, fundamentals of fish biology, capture fisheries management, aquaculture, fishing technology, fish processing and agricultural extension. The course is designed to equip senior fishery technicians and managers with necessary skills and capability to manage capture fisheries and aquaculture.

3.6. Fisheries Training Centres of the Department of Fisheries

The Department of Fisheries has training centres at Kasaka near Kafue town; Mwekera on the Copper-belt; in Mpulungu by the shores of Lake Tanganyika; at Nchelenge on Lake Mweru-Luapula; and in Sinazongwe on the shores of Lake Kariba. These centres
are an integral part of the Fisheries Training Branch of the Department of Fisheries. They are used for conducting different types of courses depending upon the determined requirements of the industry in the area at a given time.

### 3.6.1 Kasaka Fisheries Training Centre

The Kasaka Fisheries Training Centre located in Kafue is a station of the Department of Fisheries and offers certificate level course in fisheries. The course is of two years duration. The training programme at Kasaka covers a wide range of courses such as fish culture, fish biology, hydrobiology, fisheries statistics, fishing gear, boat handling, seamanship etc.

Kasaka Fisheries Training Institute was under the administrative umbrella of the Fisheries Training Unit of DoF until the year 1998 and is presently administered by the Department of Human Resources & Administration under the Ministry of Agriculture and Cooperatives.

The Fisheries training programme at Kasaka is designed for junior technicians who after completing the course, work regularly with fishermen and fish farmers. The programme is therefore designed to enable graduates of this centre to learn skills needed for them to pass the right information to participants in the fisheries sector. They are also required to collect accurate information from fishermen and fish farmers for transmission to fishery managers.

### 3.6.2 Mwekera Fisheries Training centre

The Fisheries Training Centre at Mwekera was established to cater for the need of training in fish farming. Prior to 1964, this was a fish farm and demonstration centre. In 1995, it was upgraded to a national centre, the National Aquaculture Research and Development Centre (NARDC) with funding from JICA.

At present the training centre offers three categories of training: farmers training; in-service training for DoF staff; and mobile training, often demand driven and customized. Since 1996, it has also been used a training base for the Peace Corps volunteers who have been promoting aquaculture of Nile bream (*Oreochromis niloticus*) in different parts of the country.

Since 2002, Japan International Cooperation Agency (JICA) has been funding the In-Country Aquaculture Training (ICAT) programme ([http://www.jica.or.id/english/operations/evaluation/tech_and_grant/project/term/africa/zambia_2004.html](http://www.jica.or.id/english/operations/evaluation/tech_and_grant/project/term/africa/zambia_2004.html)). The duration of this training programme is eight weeks covering eight modules on aquaculture, extension methods, project management and HIV/AIDS & gender in aquaculture. The ICAT programme was designed to operate for three consecutive years (2002-2005) with JICA funding.
Twenty participants primarily drawn from Aquaculture Extension; Research Technicians and Training Instructor of other training centres are occasionally included. The ICAT programme is organized with 3-4 experienced fish farmers to facilitate exchange of ideas, knowledge and experience. Scientists working in NARDC, Training Instructor and DoF staff work as facilitators for this training programme. The training centre has a pond facility and participants are able to have their hand-on practical exercises in fish rearing and other management measures.

The ICAT course objectives were for participants to, gain practical skills and knowledge for increasing aquaculture productivity, improve knowledge and skills in identifying problems and their root causes in aquaculture, and improve their capacity to analyse technical problems encountered and take possible measures leading to practical, appropriate and sustainable solutions.

3.7 The National Aquaculture Association of Zambia

The association was created as part of the National Aquaculture Strategy in 2006 and is affiliated to the national farmers union. The major objective of the association, involving, is to encourage the promotion of aquaculture in the country. People interviewed gave mixed reactions about the performance of the association and most staff of the Department of Fisheries were of the view that it was not playing any significant role in the promotion of aquaculture. The reason for this could be linked to the way in which such associations were formed.

This study could not undertake a detailed analysis and inventory of the membership of the National Aquaculture association but some Government officials interviewed gave the impression that the association was formed out some speculation that if such association was formed it could be easy for its members to obtain financial assistance from donors and Government projects. As such assistance has not been forthcoming, as expected and the interest in the association seems to be declining.

The Zambia National Farmers Union (ZNFU; http://www.znfu.org.zm) is a well known farmers association in the country. Aquaculture development through the association could be developed by encouraging ZNFU to take an active part in aquaculture promotion. Most members of the ZNFU are involved in traditional agriculture of maize and livestock production. ZNFU is at the moment not actively involved in fish farming though some of it members are fish farmers.

3.8 Fish Farmers

Fish farmers in Zambia may be divided into two groups: small scale and commercial fish farmers depending on the size of their operations as pointed above. Small scale farmers are a product of past aquaculture projects and extension services of the Department of Fisheries and are found in all provinces of the country. Provinces that received most of the assistance from the Department of Fisheries and donor funded projects have more small scale farmers. Commercial fish farms are relatively few and seem to have
invested in aquaculture bases on the information they obtained elsewhere. They do not obtain any assistance from the Department of Fisheries.

3.8.1 Small Scale Fish Farmers

Table 3.8.1 shows that there are six thousand four hundred and sixty two small-scale farmers in the country. The largest numbers are found in Northern, North-western and Eastern Provinces. Large numbers of fish farmers found in the Eastern Northern and North-western provinces has nothing to do with economic viability or suitability of fish farming in these provinces as compared with other areas in the country. The main reason for the high proportions of fish farmers in these provinces is largely due to availability of extension services and presence of aquaculture stations of the Department of Fisheries. In the past the Department of Fisheries promoted aquaculture mainly in high rainfall areas that do not have large natural water bodies. Experience has however demonstrated that aquaculture can be practiced in different many parts of the country including the low rainfall areas.

Table 3.8.1 Estimated number of fish farmers and number of fishponds in Zambia by province

<table>
<thead>
<tr>
<th>Province</th>
<th>Number fish farmers</th>
<th>Number of Fish ponds</th>
<th>Area of fish ponds (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lusaka</td>
<td>240</td>
<td>419</td>
<td>10.12</td>
</tr>
<tr>
<td>Central</td>
<td>618</td>
<td>925</td>
<td>10.84</td>
</tr>
<tr>
<td>Eastern</td>
<td>1,469</td>
<td>3,463</td>
<td>70.13</td>
</tr>
<tr>
<td>Copperbelt</td>
<td>201</td>
<td>446</td>
<td>11.35</td>
</tr>
<tr>
<td>North-western</td>
<td>1,988</td>
<td>3,245</td>
<td>114.50</td>
</tr>
<tr>
<td>Luapula</td>
<td>345</td>
<td>1,178</td>
<td>30.99</td>
</tr>
<tr>
<td>Southern</td>
<td>60</td>
<td>86</td>
<td>1.88</td>
</tr>
<tr>
<td>Northern</td>
<td>2,694</td>
<td>5,696</td>
<td>113.69</td>
</tr>
<tr>
<td>Western</td>
<td>126</td>
<td>236</td>
<td>7.40</td>
</tr>
<tr>
<td>TOTAL</td>
<td>6,462</td>
<td>13,910</td>
<td>341.83</td>
</tr>
</tbody>
</table>

3.8.2 Commercial Fish Farming

The Fish Culture Project in 1985 recorded 23 commercial fish farms in Zambia concentrated in areas around Lusaka and the Copper belt towns. Proximity to high population densities, major fish markets, is the principal strategy for siting commercial fish farms. In 2002, an inventory of fish farmers conducted by the Department of Fisheries revealed that there were only nine farmers practicing integrated commercial fish farming. Recent surveys indicate an increase in the number of fish farmers as indicated above. The survey in 2002 further revealed that there is one fingerling fish farmer, one crayfish farmer in Livingstone and two cage fish farmers. There certainly
has been a significant drop in the number of fish farmers practicing integrated fish farming compared to the 1985 survey. This may be surprising because since Zambia liberalised the economy in 1991, there should be now more investors in aquaculture.

Cage culture is a new fish farming method in Zambia that seems very promising. Cage culture could have expanded above current levels on Lake Kariba and other large water bodies had it not been for perceived negative environmental impacts of the practice.

### 3.9 Aqua Feed Manufacturers

The introduction of cage fish farming on Lake Kariba has created a need for the production of aqua-feeds. Two companies are currently involved in the production of fish feeds: the National Milling Company (NMC) and Tiger Feeds (http://www.tigerfeeds.com/). A survey conducted by FAO in 2002 estimated that total fish feeds production in Zambia in 2002 was 750 tonnes which was approximately 0.9% of the total commercial livestock feed production for the country (Bentley and Bentley 2002). A study conducted by Mudenda et al (2005) for the Agriculture Support Programme ASP observed that aqua-feeds are very expensive contributing over 55% to cage fish farming operations. Feeds thus contribute significantly to increasing production costs of cage fish farming operations making cage fish farming out of reach for the majority of small scale fish farmers.
4 THE REGULATORY FRAMEWORK AND POLICIES

In comparison with other countries, there has been a slow evolution of fishery legislation in Zambia. Fishery legislation has essentially not changed from the colonial times. There is need for deliberate measures aimed at improving fishery legislation so that the Fisheries Act conforms with the current policy for the management of fisheries.

Current fishery legislation in Zambia does not conform to traditions of local communities and modern fishery management practices. It is very old and outdated and inappropriate for the management and development of fisheries in the current environment. The Department of Fisheries has however taken measures aimed at updating both fishery policy and legislation.

For a long time, Zambia did not have any specific regulations dealing with aquaculture. The Fisheries Amendment Regulations of 2007 introduced, for the first time, regulations specifically relevant to aquaculture. The explanation for this situation is that when fisheries legislation was introduced in the country, aquaculture was an insignificant sub-sector and that updating of fisheries legislation has been a very slow process.

A number of fishery legislations have been used for the management of fisheries and include the following: the Fisheries Conservation Ordinance; the Fisheries Act; and the Fisheries Amendment Bill.

4.1 The Fisheries Conservation Ordinance (1962)

During the early sixties, management of fisheries was administered under the Fisheries Conservation Ordinance of 1962, Chapter 263 of the laws of Northern Rhodesia, at that time. This act placed fishery management responsibility in the Minister defined as “Member of the Executive Council for the time being entrusted by the Governor with the administration of the ordinance and the Director of the Department of Game and Fisheries”.

The Fisheries Conservation Ordinance had the following characteristics:

i) It was an Act designed to facilitate administration of a territory by a foreign power.

ii) It was highly centralised without any provisions for the involvement of civil society stakeholders and local communities.

iii) It had no provisions for the participation of local communities in the formulation and implementation of fishery management regulations.

iv) There was little flexibility and no legal framework for the devolution of fishery management authority to riparian communities in fishery areas.

Barotse-land, now Western Province of Zambia (where most of the Upper Zambezi is situated) was given special treatment in the sense that the Royal Establishment of the
area was given powers under colonial administration to control fishing. During the colonial period, Barotse land was a protectorate and not a direct colony, as is the case with other Provinces of Zambia. Clearly the Fisheries Conservation Ordinance had no specific regulations for fish farming.

4.2 The Fisheries Act (1974)

The Fisheries Act of 1974, Chapter 314 of the Laws of Zambia (now Chapter 2000) was designed to repeal the Fisheries Conservation Ordinance. There are however no fundamental differences between the Fisheries Act and the Fisheries Conservation Ordinance from both the legal and fishery management points of view. The Fisheries Act, which is still in force, places fishery management responsibilities in the national Government with no provisions for local community involvement.

Some of the changes introduced under the Fisheries Act of 1974 include the following:

i) Removal of racial and discriminatory phrases;

ii) Establishment of the Department of Fisheries;

iii) Removal of the powers of the Barotse Royal Establishment to control fishing in the Western Province particularly the Upper Zambezi; and

iv) Redefined the Phrase “Minister” to suit the post-colonial situation.

Subsidiary legislation put in place under the Fisheries Act increased the number of commercial fishery areas.

A number of good fishery management regulations which were important for the better management of fisheries under the Fisheries Conservation Ordinance were not included as part of the regulations under the Fisheries Act. Regulations that for instance restricted the number of nets a fisherman could possess were dropped in the Fisheries Act. Under the Fisheries Conservation Ordinance, setting gill nets, two-thirds the width of the river, was prohibited and this is no longer the case under the present Act, resulting in excessive fishing pressure.

The Fisheries Act in its present form can be described as follows:

i) It is very old and out dated;

ii) It is based on the colonial legislation, the Fisheries Ordinance of 1962;

iii) The Act is highly centralised, placing all fishery management responsibilities in the Minister and the Director of Fisheries.

iv) There is very little provision for the involvement of local communities and other stakeholders in the formulation and enforcement of fishery management regulations;

v) The Act does not have detailed provisions for the management and development of aquaculture;

vi) The Act does not provide guidelines for the management of shared or trans-boundary fisheries;

vii) The Act does not include any of the regional and international agreements for the management of fisheries and aquatic resources.
In order to address these and other related problems the Department of Fisheries requested for assistance from the Food and Agriculture Organisation (FAO) of the United Nations in 1996. Although a comprehensive draft of a new Fisheries Act was prepared in 1997 it has not yet been passed into law by 2009 and accepted by Government for enactment. There is therefore urgent need to revive the issue and update the Fisheries Act.

In view of the time that may be needed to revise and update the Fisheries Act, the Zambia Government passed the Fisheries Amendment Bill of 2007. The main objective of the 2007 Amendment Bill is to include representatives of local communities in the management and development of fisheries. When the Fisheries Policy document is in place, it should therefore pave a way for phasing out the present Fisheries Act and replace it with one that will be a better reflection of the new fishery management policies.

4.3 Proposed Fishery Legislation (1998)

With assistance from the Food and Agriculture Organisation of the United Nations the Department of Fisheries prepared a draft Fisheries Bill from 1997 to 1998. The draft fisheries bill aims at including the following aspects in the fisheries legislation of Zambia:

i) The need to decentralise and devolve fishery management responsibilities to local communities in fishery areas;

ii) To facilitate participation of local communities and fishermen in the formulation and enforcement of fishery management regulations;

iii) To include several aspects of aquaculture development in the fisheries legislation;

iv) To conserve aquatic habitat and fauna;

v) To facilitate improved management and conservation of fisheries in accordance with international resolutions such as the Code of Conduct for Responsible Fisheries; and

vi) To broaden the definition of fish to include both shell and fin fish. Above all, the draft Fisheries Act has provisions relating to co-operation with other countries in management and development of fisheries.

An important aspect of the draft Fisheries Act is the establishment of a Central Fisheries Board and Fishery Management Boards for each commercial fishery area. Both the Central Fisheries Board and the Fishery management Boards for fishery areas will have ordinary members appointed by the Minister as members of the Boards. Ordinary members of a Fishery Management Board should be residents of the fishery area where the Board is appointed. There is a provision that among the ordinary members appointed by the Minister, some of them should be traditional rulers or representatives of Chiefs resident in the fishery area. Proosals to appoint ordinary members, representatives of Chiefs and traditional rulers to Fishery Management Boards, are
designed to enhance the participation of local communities in fisheries management and development.

4.4 Fisheries Amendment Act (2007)

It has been considered that some of the proposals included in the Draft Fisheries Bill of 1998 would also require revision of the Constitution. Pending review of the Zambian constitution the Government has in the interim approved an amendment to the Fisheries Act. The amendment to the Fisheries Act in the Fisheries Amendment Act of 2007 includes the following:

i) Provision for the establishment of fishery management committees in fishery areas to facilitate involvement of local communities in fisheries management;

ii) Provisions for putting in place regulations to control and coordinate aquaculture development;

iii) Establishment of a fund to be used in the development of the fisheries sector.

The amendment does not propose to change fisheries legislation in the same manner as envisaged by the draft bill of 1998. However, the Fisheries Amendment Act of 2007 has several provisions for aquaculture and definitions of the following are provided: aquaculture; aquaculture development plan; and aquaculture facility.

In addition Part IVA is devoted to aquaculture regulation. This part of the Amendment Act sets regulations for the following:

i) Prohibitions for engaging in aquaculture;

ii) Application for an aquaculture licence;

iii) Restrictions for transfer of an aquaculture licence;

iv) Conditions for an aquaculture licence;

v) Requirements for conducting an Environmental Impact Assessment for aquaculture facilities;

vi) Inspection for proposed site for aquaculture;

vii) Prohibition for interfering with aquaculture facility;

viii) Restrictions on the use of chemicals in aquaculture; and

ix) Aquaculture development plans.

It has however been observed that the regulations for aquaculture are framed or structured in the same manner as those dealing with the capture fisheries. During the deliberations on the Draft Fisheries Bill concern was expressed regarding the need for a licence to engage in aquaculture. It was felt that this will not encourage the rapid development of fish farming in the country. The inclusion of aquaculture regulations in the fisheries has been welcomed as a positive development. What is now being awaited is to find out if the regulations will have a positive impact on the development of the industry.
5 DEVELOPMENT PLANS AND FISHERIES

5.1 General

The Government has been compelled to put significant attention to developing plans for the fisheries sector because of its strategic importance in development since the early fifties. Policies for the fisheries sector at different times were reflected through National Development Plans.

The Zambian governance and planning history can be briefly summarised as characterised by “a stop-start” administrative system. This is not necessarily as a result of lack of development policies, but largely as a result of weak implementation of policies. It very easy to introduce policies in Zambia but problems often arise during implementation (World Bank 2004). This suggests that methods used to introduce policies need critical review - in most cases a top down approach was employed where stakeholders were not consulted in the formulation of development policies and programmes.

Zambia became an independent state in 1964 and was governed as a multi-party democracy until 1972. Between 1972 and 1991, it was administered as a one party state with a centralised bureaucracy. Multi-party democracy was reintroduced in 1991. Administration of the fisheries sector has been affected both directly and indirectly by the type of Government structure at national level.

National development plans and policies for the fisheries sector have changed over the years. The Zambian fishery development plans, in the past, placed more emphasis on the development of the natural fisheries. This is because capture fisheries tend to be more important and affect more people compared to aquaculture.

The following development plans that included some aspects of fisheries have been implemented:

i) The Pre-independence Development plan (1953 - 1965);
ii) The First National Development Plan (1966 - 1970);
iv) The Third National Development Plan (1977 - 1982);
vi) The Fourth national Development Plan (1989 - 1991);
vii) The Fisheries Sub - Programme of the Agriculture Sector Investment Programme ASIP (1997 – 2001) and
x) The National Aquaculture Strategy
xi) The Fifteen Years Fisheries Development Plan (2003 – 218); and
xii) The Fifth National Development Plan.
xiii) Draft National Aquaculture Development Plan
The first four national development plans placed considerable emphasis on the expansion of the fisheries sector with little effort to assess the capacity of the natural fisheries to withstand increasing fishing pressure. Development plans that followed, including the fisheries sub-programme of ASIP, attempted to address problems caused by overexploitation in the capture fisheries sector and development of aquaculture.

Nearly all the development plans have not been fully implemented. Shortage of resources particularly finances have in most cases adversely affected their implementation.

5.2 Pre-Independence Development Plan

Starting from the early 1950s to 1965 the Zambian economy and the fisheries sector were administered based on the ten years development plan of 1953. The fisheries component of the plan put emphasis on assessing the ecology of fish and aquatic habitats. During this period, fish supply from the natural fisheries was sufficient to need national demand. As a result, there was no emphasis on aquaculture development. From 1966 until 1991, Zambia implemented four five-year national development plans that included components for the development of fisheries and aquaculture.

5.3 The First National Development Plan

The first National Development Plan (1966 to 1970) had, as its main objective to provide the basic infrastructure required for development of the fisheries sector. The core activities of the plan, for fishery development, were to improve fish landing, handling, recording, and processing. Most of the expenditure under the plan was targeted at construction of markets and fish storage facilities in fishery areas. The plan did not put emphasis on aquaculture development, apparently because capture fisheries and imports easily provided sufficient quantities of fish required.

5.4 The Second National Development Plan

The second National Development Plan (1972 to 1976) was not significantly different from the first one and had four main development objectives for the development of the fisheries sector: to increase the harvest of fish by 1976; to establish an effective marketing organisation to enable fish to be made available in some form to consumers throughout the country; to improve fishing equipment and techniques; and to produce better quality fish fresh, frozen and dried as a valuable protein source. This plan did no set any priority to aquaculture development.

5.5 The Third National Development Plan
The Third National Development Plan (1977 to 1982) had the following major objectives: to increase production in fish in order to achieve self-sufficiency; to increase incomes of fishermen through efficient marketing, credit and extension work; to improve the techniques of monitoring more accurately the status of the fisheries and improve production and distribution techniques through research and data collection programme; improve the collection and distribution of fish available in all areas; promote fish farming, particularly in fish deficient areas; and to improve the quality of equipment and methods of fishing.

5.6 The Interim National Development Plan

The Interim National Development pursued from 1987 to 1988 was not different from the above-mentioned plans. The fisheries section of the Interim Development plan included the following objectives: increasing fish production; increasing per capita consumption levels of fish; create opportunities for employment and incomes of fishermen and fish farmers; and provide credit and other incentives to fishermen and fish farmers so that they can expand their operations.

The interim national development plans did not offer anything very new. It was similar to previous National Development Plans in several aspects. The plan was to be implemented with emphasis on economic growth that had to be realised based on the nation’s own resources. Fisheries resources were viewed as one of the key areas where economic growth could be based. The period for the implementation of the plan was too short to observe any results in the fishery sector related to the plan.

The Interim National Development Plan was formulated and implemented at a time when the Government suspended its relations with international financiers, IMF and the World Bank. This was the reason for the emphasis on economic growth based on the country’s resources. When contacts were resumed with international financial institutions indicated above, the Government started preparation of the Fourth National Development Plan.

5.7 The Fourth National Development Plan

During the preparation of the Fourth National Development Plan, the negative effects that could be caused by uncontrolled expansion of fisheries were highlighted. This development plan placed great emphasis on fish resources assessments so that results of research investigations could be used in fisheries planning and development.

The Fourth National Development Plan was designed to be implemented from 1989 to 1993 and contained two components for the natural fisheries sector: limnological; and fish stock assessment. Regarding limnological investigations, the plan included the following components: to study the morphometric characteristics of selected water bodies in order to assess influence of river / lake basin size, soil type of the catchment area; precipitation on fisheries; study the inter-relationship of various parameters, likely to have an effect on nutrients, radiant energy, aeration and primary productivity; study
the abundance and distribution of aquatic plants and invertebrates in order to assess their influence on the abundance, behaviour and distribution of fish; restock, selected depleted lakes and river systems for increased productivity.

For the capture fisheries, the Fourth National Development Plan has the following major objectives: to implement biological research aimed at the optimal utilisation of the resources; to provide extension services to artisanal fishermen: in fishing gear fish processing; to strengthen the national research centres; to train national personnel in order to improve their efficiency; to co-ordinate fisheries research; and promote international collaboration in the management of shared resources as means of stimulating sustained fisheries development.

With regard to aquaculture development the plan put emphasis on fish seed production as a way of supporting aquaculture development. The Forth National Development Plan acknowledged the development of aquaculture in the Third National Development Plan.

The plan was not implemented for a period of five years as originally planned. There was a change of Government in 1991. The political party that formed the Government in 1991 had different economic development strategies and policies for the fisheries sector. The Fourth National Development Plan was therefore officially abandoned though it had several positive aspects some of which are relevant for fisheries and aquaculture development even in the current fisheries environment.

5.8 Fisheries Development Programme

In 1992, immediately after the change of Government, the Minister of Agriculture, Food and Fisheries appointed a Task Force to prepare an Agriculture Sector Investment Programme (ASIP). Its terms of reference included preparation of development programmes for the Ministry suitable for a liberalised economy. The mandate of the Task Force included fisheries since by that time, the Department of Fisheries was placed under the Ministry of Agriculture.

Objectives for fisheries development as formulated by the Task Force were as follows: to increase total fish production; to improve fish conservation awareness and to ensure that the methods used in fishing are those that conserve fish stocks; to improve the economic status and conditions among small-scale fishermen fish farmers and boat builders and fish traders; to carry out a programme of applied research and information gathering that will be the basis for fisheries planning and development; and to develop types of aquaculture that have the potential for becoming economically viable.

The overriding policy objective for fisheries development, at present, is that the sector should contribute positively to real economic growth. Increase in fish production, needs to be sustainable and should not result into environmental degradation. Indirectly, this policy approach encourages development of commercial aquaculture and subsidies for the fishing sector are discouraged.

The performance of the first phase of ASIP is considered unsatisfactory by the ASIP review report (2002). One of the reasons for the unsatisfactory performance of ASIP is that it was implemented at a time when the Ministry of Agriculture was undergoing a
major restructuring programme and most positions key to the implementation of ASIP remained vacant for a long time. Another reason is that structure of the Ministry of Agriculture designed during ASIP implementation was not properly worked out and was appropriate for implementing most of the development programmes.

This assessment does not only apply to the fisheries sub-programme alone but all the components of the Agriculture Sector Investment Programme. It is mainly for this reason that the Government and donors supporting the fisheries sector felt that there was need to have an overall strategy and common approach in formulating, designing and implementation of fisheries development projects including annual work-plans for the Department of Fisheries. It was therefore decided that there should be a long term fisheries development strategy and this resulted in the formulation of the Fifteen Year Strategic Fisheries Development Plan.

5.9 The Fifteen Years Strategic Fisheries Development Plan

The Fifteen Years Fisheries Development Plan (2003 – 2018) is an initiative of the Fisheries sector and its major donors, mainly JICA. JICA provided the funding for the preparation of the fisheries development plan. Preparation of the long term development plan was implemented in two phases: Phase I included a comprehensive reviews of the fisheries and aquaculture sector; and Phase II was devoted to the design of the plan and presenting it to stakeholders.

During Phase one of the preparation of the strategic plan, from 2002 to 2003, four documents were prepared reflecting a comprehensive review of the fisheries and aquaculture sector and these included: a review of the state of aquaculture in Zambia; an overview of the capture fisheries; an evaluation of institutional arrangements and fisheries training; and an updated bibliography of fisheries and aquaculture in Zambia. These documents have been useful in the designing fisheries and aquaculture programmes.

During the second phase, the plan was formulated based on the results of the information generated during the first phase. Workshops were held in different and selected parts of the country where aquaculture and capture fisheries are important. These workshops in different parts of the country culminated in hosting a national workshop which was held in Lusaka. One of the objectives for conducting such consultation workshops was to seek views and support for the plan from all stakeholders.

The main reason for developing the Fifteen Years Strategic Fisheries Development Plan was that donors for the Zambian fisheries, and particularly the aquaculture sector, had invested considerable resources in promoting aquaculture through the construction of the national Aquaculture Research and Development Centre at Mwekera on the Copper-belt Province. The documents that were prepared were mainly for internal use of fisheries officials and were not circulated widely outside the Ministry of Agriculture and Co-operatives.
It may be difficult to assess the success of the Fifteen Years Fisheries Development Plan because it has been overtaken by other related programmes such as the Fifth National Development Plan and Vision 2030. Its major achievement possibly is that information generated during its implementation was useful in the preparation of annual budgets and work-plans for the Department of Fisheries, as well as in the design of the Fifth National Development Plan and Vision 2030.

5.10 The Fifth National Development Plan and Vision 2030 (www.unda.org.zm)

In 2005 the Zambian Government changed its development strategy and decided to re-introduce development plans in the manner that they were formulated and implemented before 1991. Zambia has now put in place a National Long Term Vision 2030, (“Vision 2030”) whose objective is to become a prosperous middle income country by 2030. This vision is operationalised through five year medium term planning instruments. The Fifth National Development Plan (FNDP) 2006-2010 is the first of these Plans. The FNDP was officially launched in January 2007 but its implementation started with the 2006 National Budget.

The Fifth National Development Plan was launched in 2007 and the objective for the fisheries sector is stated as follows: To increase fish production and promote sustainable utilization of fisheries resources thereby contributing to the economy through the generation of employment, income and improved availability of fish. The fisheries component of the Fifth National Development Plan has the following components:

a) Aquaculture Development;
b) Capture Fisheries Management and Development;
c) Fish Processing and Marketing; and
d) Fisheries Training

5.10.1 Aquaculture Development

The Fisheries component of the Fifth National Development Plan aims at promoting aquaculture by adopting the following developmental strategies:

i) Providing appropriate extension services and facilitate production and distribution of quality fish seed.
ii) Promote the formation of fish farmers groups/associations and develop their capacity.
iii) Develop and enforce legislation on aquaculture
iv) Promote availability of fish farming inputs with private sector participation.
v) Undertake social economic studies for aquaculture development
vi) Encourage development of fisheries of small water bodies.
vii) Conduct fish feed trials to determine the suitable feeds for aquaculture using locally available material
Aquaculture development has been accorded high priority in the Fifth National Development plan and this arises from the fact that capture fisheries are either fully or over-exploited. Significant increase in fish production can be realised from aquaculture particularly commercial fish farming.

**5.10.2 Capture Fisheries Management and Development**

The Fisheries component of the Fifth National Development Plan (FNDP) aims at improving the performance of the natural fisheries by adopting the following developmental strategies:

i) Provide the legal framework for community participation in sharing the responsibility for better management of aquatic resources.

iii) Conserve and maintain bio-diversity of aquatic resources through improved monitoring, creation of fish sanctuaries.

iv) Regulate fishing practices through appropriate legislation.

v) Improve management and monitor exploitation, transportation, and trade of ornamental fish species.

vi) Facilitate capacity building among stakeholders in the fisheries sub-sector.

vii) Collaborate with neighbouring countries in the management of aquatic resources in shared watercourses or water bodies.

viii) Strengthen legislation to provide for sustainable exploitation of the fisheries resources.

ix) Promote the formation of fisher groups/associations for effective dissemination of capture fisheries management information and appropriate fishing techniques.

x) Promote c-operation between research institutions within and out side the country.

xi) Develop short, medium and long-term fisheries research plans for the country in consultation with stakeholders.

xii) Strengthen and improve fishery data collection, analysis and dissemination systems in order to maintain and regularly update the fisheries database.

xiii) Strengthen institutional capacity for effective implementation of research programmes.
xiv) Conduct research on post harvest handling, losses and quality assurance by applying methodologies and techniques that are environmentally friendly.

xv) Improve fish quality by applying HCCP standards.

xvi) Assess the ecological impact of exotic fish species on indigenous fish species in all aquatic systems.

Even though the Fisheries component of the FNDP has put the development of aquaculture as first priority, natural fisheries will remain the main source of fish for the country for a long time. The strategies indicated above are designed to facilitate a sustainable increase in fish production from natural water bodies. They are also expected to result in the recovery of the over exploited fish stocks.

5.10.3 Fish processing and Marketing

The FNDP aims at adopting the following interventions and strategies with a view of improving the quality of the marketed fish:

i) To design plans aimed at reducing time taken between fish capture and consumption;

ii) Provide techniques that would add value to fish and fishery products;

iii) Improve post-harvest management;

iv) Provide market information to fish producers processors and traders;

v) Conduct research on post harvest handling, losses and quality assurance by applying methodologies and techniques that are environmentally friendly;

vi) Improve fish quality by applying HCCP standards; and

vii) Encourage formation of fish marketing groups and co-operatives.

It has been observed that there are significant post harvest losses particularly in the artisanal fisheries sector. Most of the fish marketed is of low quality. The plan therefore aims at putting forward a number of interventions so as to improve the quality of the marketed fish. Aquaculture expansion is also a strategy for fish quality improvement as fish from aquaculture is marketed fresh and is not exposed to post harvest losses as compared to fish from the wild.

5.10.4 Fisheries Training

The Fifth National Development Plan aims at improving fisheries training by adopting the following strategies:

i) Develop training programmes in fisheries and aquaculture locally

ii) Conduct short sensitisation courses for fishers and fish farmers

iii) Encourage collaboration among institutions involved in fisheries training

iv) Liaise with regional and international fisheries training centres

Aquaculture training has not been given emphasis in the past because of the traditional bias in favour of natural fisheries. The training programmes of the Fisheries Department
at Kasaka Fisheries training Centre and at the Natural Resources Development College are good examples of such a situation. The plan therefore, in addition to introducing more aquaculture training programmes in local institutions, also aims at sensitizing community leaders and several institutions on the value and significance of aquaculture.

5.11 The National Aquaculture Strategy 2006

Zambia is one of the countries that has developed and put in place a National Aquaculture Strategy with assistance from the Food and Agriculture Organization (FAO) of the United Nations which was launched in 2006. Studies leading to the development of the National Aquaculture Strategy started as far back as 2002.

The Strategy identifies four critical areas needed for aquaculture development in the country which are: the need for institutional reform; strengthening regulatory framework for aquaculture; creation of an enabling environment for aquaculture expansion and developing and increasing competence in fish farming. The Strategy is not significantly different from the Fifth National Development Plan and the Draft National Fisheries Policy in the sense that more emphasis is being put on the development of Aquaculture.

5.12 Draft National Fisheries Policy

Policy pronouncements for fisheries development in Zambia have all along been reflected in documents such as: national development plans; National Environment Action Plan (NEAP); and agriculture policy documents. Inclusion of fisheries policy strategies in agriculture policy documents is largely due to institutional arrangements where the Department of Fisheries was placed in the Ministry of Agriculture. In recent years, there has been a growing realization that such arrangements have not facilitated highlighting fisheries issues properly, particularly in view of the fact other natural resources sectors such as: forestry; wildlife; and water are separately mentioned in policy documents.

In 2006, the Ministry of Agriculture and Cooperatives established a technical committee to formulate and co-ordinate preparation of the National Fisheries Policy. For the period that the committee has been in existence, it has produced a Draft National Fisheries Policy Document.

In the area of aquaculture, the policy aims to facilitate an increase of aquaculture production so as to reduce the gap between fish supply and demand for food fish, but in a manner that environment protection is observed and biological diversity conserved.

The draft policy highlights the potential of fish farming to contribute to food security, household poverty eradication, exports, employment and wealth creation. In addition, aquaculture is easily compatible with agriculture and is easily integrated into household farming systems with a potential real impact on the protein intake of the rural poor.

To be sustainable, aquaculture systems must fit within the social and economic context of the agricultural production systems in which they are found or introduced. In Zambia,
there has not been a deliberate policy initiative to encourage large-scale intensive or semi-intensive commercial fish farming. Consequently the Zambian aquaculture sector is dominated by small scale operators keeping fish in ponds dug in gardens. This draft policy aims at transforming aquaculture into a vibrant industry particularly in peri-urban areas.

It is expected that in 2009 the draft fisheries policy document shall be circulated and discussed by all major stake-holders before adoption by the Government. When the draft policy document is adopted it will form a useful guide for designing aquaculture development projects and regulations for managing the sector as indicated above.
6 AQUACULTURE DEVELOPMENT PROJECTS

During the last thirty years the Department of Fisheries has implemented several aquaculture research and development projects such as:

   i) The Fish Culture Development Project (1980-1989);
   ii) The Aquaculture for Local Community Development Programme (ALCOM) (1985 – 1996);
   iii) The Fish Culture Adaptive Research Project (1982 – 1995);
   iv) ICARA I AND ICARA II (1982-1987);
   v) The Fish Hatchery Project (1990 – 95); and
   vi) National Aquaculture Research and Development Centre 1996 - To Date

Implementation of such projects has influenced development of fish farming in the country through the growth and interest that has been realised in the past. The main emphasis for the implementation of the projects indicated above was to introduce fish farming as a viable food production system for rural communities in order to improve household food security. Through the implementation of such projects the Department of Fisheries seems to have succeeded in introducing fish farming as a dependable food production system. It has however not been able to popularise aquaculture as a viable income generating activity. This may be one of the reasons for the slow growth of aquaculture in relation to the potential for expansion.

In order to accelerate aquaculture development different strategies should be investigated and employed. Development of aquaculture projects that will result in accelerated development aquaculture can best be realised if there is a good understanding of the aquaculture sector and the impact that previous development projects had on the development of fish farming

6.1 The Fish Culture Development Project (1980-1989)

The Fish Culture Development Project was implemented from 1980 to 1989. Initially the project was based at Chilanga, which became the project headquarters (http://www.fao.org/docrep/field/003/AC086E/AC086E00.HTM). In latter years, the project activities spread to Chipata in the Eastern Province and to Mwekera near Kitwe on the Copper-belt.

The main objectives of the Fish Culture Development Project were to consolidate results of previous fish farming trials and to test the economic viability of aquaculture. In addition, the project continued to demonstrate aquaculture as a viable food production system and as a potential commercial industry in the country (Gopalakrisman, 1985 FAO/GRZ. 1990).

Through this project it was demonstrated that, under good management, production rates of up to 7 to 9 tonnes per hectare per year could be realised using integrated fish
farming systems. Previous trials reported by Kavaleck (1975) and Williams (1977) indicated that yields of 6.6 tonnes per hectare per year could be realised. The project demonstrated that mono-sex aquaculture could improve pond productivity. It addition it also demonstrated that commercial aquaculture could be undertaken profitably in places near urban areas.

http://www.fao.org/docrep/005/AC991E/AC991E01.htm

The Aquaculture for Local Community Development Programme (ALCOM) was a regional project that covered all the SADC countries. The main objective of the ALCOM programme was to develop, test and demonstrate techniques through which rural communities can improve both their income and nutrition through fish farming.

In Zambia, the ALCOM programme had extension and development activities in the following three provinces: Central, Eastern and Luapula Provinces. The programme had a component dealing with fisheries of small water bodies, which had activities in the Eastern and Southern Provinces. ALCOM project again demonstrated that rural communities can improve food security at household level through aquaculture (Wijkstrosam, 1991ALCOM.1994).


The Fish Culture Adaptive Research Project was implemented in the Northern Province. The project had its Headquarters at the Department's fish culture station at Misamfu in Kasama.

The main objective of the Fish Culture Adaptive Research Project was to increase fish production from small-scale fish farmers and to improve nutrition in the province. The project established satellite stations at other places in the province such as Chinsali, Isoka, Mpika and Nakonde and demonstrated that there is potential for fish farming in the Northern Province (NORAD 1986).

6.4 ICARA I AND ICARA II (1982-1987)

This project was originally aimed at assisting the refugee community in the North Western Province and was supported by the Catholic Church. Local communities in the area also benefited from activities of the project.

The project supported the construction of more than 1,000 fishponds in Maheba refugee camp area in the North-Western Province. It also introduced a community based extension approach, which used extension agents living in the refugee communities. An important lesson that was provided by this project is that aquaculture if properly managed and executed, can benefit and be adopted by non-target communities. As a result of the ICARA project non-refugee communities who were not the main targets in the North-western Province adopted aquaculture.
6.5  The Food Production and Income Generation through Fish Ponds in Zambia Project (1992 - 1996)

This project was implemented in the North Western Province and has its Headquarters at Mwinilunga. The Food Production and Income Generation through Fishponds in Zambia is successor to the ICARA II fishpond project.

After the ICARA II project came to an end, fish farming started declining in the area mainly due to lack of fish fingerlings and extension services. An important component of this project is that it had a small credit component where fish farmers could borrow money for pond construction. Experiences of this project demonstrate that a credit scheme can be designed and successfully implemented for aquaculture projects.

6.6  The Fish Hatchery Project (1990 – 95)

The Japan International Cooperation Agency (JICA) funded this project in collaboration with the Zambian Government. The major aim of this project was to improve the supply of fish seed (fish fingerlings) to farmers particularly of the carp family. The project put up a modern fish hatchery complex that has the capacity of producing over one million fingerlings of the carp family in a year.

The fish hatchery constructed at Mwekera on the Copper-belt is considered to be ideal and strategic for aquaculture development in the country. The Copper-belt is in a high rainfall area and receives sufficient rainfall. It is relatively central and the hatchery is servicing important fish farming areas in the country, such as Luapula, Northern and North Western Provinces.

The project managed to develop methods for the production of fingerlings including those for the Carp species. With experiences available with other Government fish farms, it was demonstrated that fingerling supply could be a viable business venture on its own, particularly if the fish-farming sector expands.

6.7  Japanese Grant Aid to the National Aquaculture Centre (1996 – 1998)

In 1997 the Japanese Government provided a Grant Aid whose objective was to rehabilitate and upgrade the infrastructure of the aquaculture station at Mwekera and to equip the laboratories so that the centre could conduct research work. The project put up infrastructure that is appropriate for supporting aquaculture research.
Infrastructure put up at the centre, even though originally intended for research work, is also used directly to support fisheries training programmes. Some of the work conducted at the centre is directly supporting fish farmers and extension programmes. Activities of NARDC have confirmed the importance and relevance of research in developing the aquaculture sector.

6.8 ZAP/RAP (1996 to date) [www.usemb.org.zm](http://www.usemb.org.zm)

This is a Peace Corps programme that started as ZAP in 1996. It provides volunteers to local communities who provide extension service in fish farming to communities in collaboration with the Department of Fisheries. Currently, the programme has fish farming extension agents in Northern, North-Western, Copperbelt, Luapula and Central Provinces. RAP has succeeded in promoting direct supervision of constructing and managing fishponds since volunteers live in villages with fish farmers. In addition, the project has also promoted farmer-to-farmer extension.

Even in the absence of a detailed inventory on aquaculture, it is clear that fish farming seems to have expanded in those areas were the project operates. An important lesson provided by this project is that for aquaculture to develop, intensive supervision at local level of extension services is critical. It is therefore recommended that future aquaculture development programmes by the Department of Fisheries and other participants in the industry could focus on how to effectively increase provision extension services.

6.9 Smallholder Aquaculture Programme SHAP (1998 - 2001)

This project worked in collaboration with the Rural Aquaculture Programme in: Northern; North-western; Luapula, Copper-belt and Central Provinces. The overall objective of the project was to increase incomes and enhance food security for the rural smallholder farmer, especially women and youth, through the promotion and establishment of aquaculture enterprises. Aquaculture extension agents who worked under SHAP have begun to integrate the RAP extension approach and technical standards through training and field collaboration. The project demonstrated that aquaculture can be an important income generating activity for rural farmers, if a right approach is adopted.

6.10 National Aquaculture Research and Development Centre (1996 - To Date)

Initial activities of the centre included conducting aquaculture research in fish seed propagation, fish feed formulations, and assessing the pond environment. This research was linked to the strengthening of the activities of the fish hatchery project. The work also focussed on the mass propagation of fish seed particularly the Common Carp (NARDC 1997). This was out of the realization that there is a very high demand for fish seed to sustain expanding aquaculture production. A major objective of this project was to initiate and organise aquaculture research for the whole country. In order to achieve
this infrastructure needed for research had to be put up. This was achieved by the Japanese Grant Aid project described below.


The In-Country Aquaculture Training (ICAT) project was operational from 2002 to 2004 and was organised at the National Aquaculture Research and Development Centre (NARDC) with support from JICA. The objective of the project was to strengthen the aquaculture research extension through improvement of knowledge and skills among extension agents so that they are able to advise farmers in ways of improving productivity.

During its lifespan, from 2002 to 2004, the project conducted three courses each lasting eight weeks. There were twenty participants expected for each training session. A total of 59 participants took part in the three training sessions. At the end of the project an evaluation was conducted which concluded that implementation of the project had been successful.
6.12 The Farmer Based Aquaculture Training (FAT) 2006 - 2008

FAT was a Training Technical Cooperation Project between the Governments of Japan (through the Japan International Cooperation Agency (JICA) and the Government of the Republic of Zambia (GRZ). The Project was implemented by the Department of Fisheries (DOF) in the Ministry of Agriculture and Cooperatives (MACO). The period of the cooperation agreement was from August 2006 to 31st March 2008.

FAT was implemented through the Project Management Unit (PMU) that was based at the National Aquaculture Research and Development Centre (NARDC) in Mwekera, Kitwe. The PMU was headed by the Project Manager who was also the officer in Charge of the Centre. The PMU was responsible for day to day management of the Project. The Project commenced in August 2006, when it was signed and the completion date was March 2008. At the completion of the activities of the training cooperation it became necessary to undertake an evaluation of the project.

The main objective (or purpose) of the course was to empower small-scale and rural fish farmers with relevant aquaculture knowledge and skills in order to increase aquaculture production.

The specific objectives (or outputs) were to enable farmers to: gain skills and knowledge for increased aquaculture productivity and profitability; improve backward and forward linkages in their communities; gain entrepreneurship skills and knowledge on aquaculture as a business.

Five training sessions were conducted covering the five following provinces: Central; Copper-belt; Lusaka; North-western and Western Provinces. Each training activity covered 20 farmers, leading to a total of 100.
7 THE DRAFT NATIONAL FISHERIES POLICY

The Department of Fisheries has prepared a National Fisheries Policy document that describes in detail policies for the development of aquaculture. Even though the document has not yet been approved by the Government it is very unlikely that the final document will be significantly different from the current draft. This is because the Department has consulted with the political leadership and communities in preparing the current one. The Department of Fisheries plans to hold provincial and national workshops as a way of further sensitising stakeholders and about the significance of the draft policy document but do not have the finances to conduct this sensitization.

According to the Draft Fisheries Policy document, Aquaculture production will be increased so as to reduce the gap between fish supply and demand for food fish but in a manner that environmental protection is observed and biological diversity conserved (Department of Fisheries 2008).

7.1 Policy Objectives for Aquaculture Development

According to the Draft National Fisheries Policy document policy objectives for developing aquaculture are as follows:

1. To increase the quality and quantity of aquaculture production at both small-scale and industrial levels.
2. To ensure and increase the production of a diversified range of fish products including finfish and crustaceans from aquaculture.
3. To identify fishery areas with potential for live ornamental fish production and encourage development of aquarium fisheries;
4. To increase fish production in small water bodies.

7.2 Policy Strategies

Policy strategies, for realising the above objectives, for the central government, local government at provincial and district levels and the civil society are stated as follows and follows:

7.2.1 The Role of the Central Government:

The Central Government is, according to the Draft National Fisheries Policy document, expected to continue to play key roles in facilitating aquaculture development and its core functions should be restricted to the following:

i) Involving all stake-holders particularly local institutions in the implementation of research relevant to the needs of the sub-sector;
(ii) Expand and diversify production of farmed fish species;
(iii) Encourage production of high value local species such as (African catfish and Crayfish);
(iv) Encourage, guide and promote small scale semi-intensive poly culture for rural farmers; large scale semi intensive mono sex for progressive farmers or middle class;
V) Encourage diversification and the development of new technologies to reduce production costs and exploit new areas or opportunities for aquaculture production;
(vi) Set standards and guidelines for fisheries management and development at districts;
(viii) Encourage involvement of communities in restocking and management of stocks water reservoirs and minor lakes; and
(ix) Ensure effective participation of NGOs and CBOs in the promotion of rural based aquaculture development programmes
(x) Encourage out-grower schemes for fish culture development and expansion

7.2.2 The Role of Local Governments Provincial and District Levels

The draft National Fisheries Policy document lists the roles of local Government at provincial and district levels as follows:

i) Be responsible for local level planning for aquaculture development;
ii) Support development of private seed production with emphasis to supplement Government fish farms
iii) Ensure that farmers receive the right and appropriate technical guidance and advisory services on aquaculture practices;
iv) Encourage and empower farmers through formation of fish farming groups co-operatives and associations;
v) Formulate good aquaculture practices by setting up technology dissemination centres for aquaculture;

7.2.3 The Role of Civil Society

Civil society is envisaged to play major roles in promoting aquaculture and which are listed as follows:

i) Support training of farmers in aquaculture practices
ii) Promote aquaculture among the rural poor by provision of advise, basic inputs and financial support for aquaculture operations.
iii) Support on-farm trials and demonstration centres for aquaculture development;
iv) Organise farmers into fish farmers associations and groups;
v) Support and promote exposure of farmers to new technologies and practices in aquaculture
vi) Assist poor farmers in establishing appropriate aquaculture production systems, through provision of inputs and credit.
According to the Coordinating Unit of the Department of Fisheries for the preparation of the National Fisheries Policy document, the National Fisheries Policy would be a useful guide for the revision of the Fisheries Act, designing of fisheries and aquaculture management and development plans, and redesigning the structure of the Department of Fisheries. As observed above the structure of the Department of Fisheries has been redesigned on several occasion and at times without any policy direction.

In the past, fisheries and aquaculture policy documents were included in agriculture policy documents since the department of Fisheries has been placed in the Ministry of Agriculture since 1982. There is a view among most people contacted that such an arrangement did not provide an environment for stating fisheries and aquaculture policies appropriately and tend to have marginalised the fisheries sector since the other natural resource sectors such as: forestry; water and wildlife have stand alone policy documents.

The Draft national Fisheries Policy as is the case with other recent documents in fisheries such as the Fifth national Development Plan and Aquaculture Strategy realises the need for the commercialization of aquaculture in Zambia and the active involvement of several actors. There is certainly need to get more institutions involved in aquaculture development.
Zambia seems to have gained considerable experience in developing fish farming through implementing several aquaculture development projects, formulating several development plans and working with various donor organizations. Despite this experience, the growth of aquaculture in the country is still below small. In order to realise full potential for the development of aquaculture in the country different programmes and projects could be implemented. A summary of some projects and programmes that could be implemented to facilitate development of aquaculture is provided. Some of the policy consideration for and options for developing aquaculture include the following:

i) Improving institutional arrangements for aquaculture development
ii) Encouraging participation of local financial institutions in aquaculture development
iii) Supporting aquaculture extension system
iv) Supporting specialisation in different areas of aquaculture
v) Strengthening aquaculture research
vi) Strengthening institutions involved in aquaculture training
vii) Strengthening linkages and cooperation in aquaculture development and
viii) Finalizing preparation of the National Fisheries Policy document

For each programme and project proposed, a detailed study will be needed to determine modalities under which a particular programme could be implemented. It is also critical to bear in mind that the Ministry of Livestock and Fisheries development has several ongoing programmes and projects as well as development plans such as the Fifth National Development and Vision 2030. The suggested programmes and activities should be viewed in the context of the existing implementation structures of the Ministry.

8.1 Institutional Arrangements for Aquaculture Development

Institutional re-organization is currently an ongoing programme of the Zambian public service through the Public Service Reform Programme (PSRP). It is clear that some institutional changes are needed in order to facilitate promotion of aquaculture. The Department of Fisheries was originally designed and established to manage natural fisheries under a centralised management system. At the time when the Department of Fisheries was established and designed, the country met all its fish needs from the capture fisheries. Currently there is realization within the Department Fisheries that its centralised structure is not adequate for the management of fisheries.

Although the structure of the Department of Fisheries was changed on a number of times in 1974 and in 1992 as demonstrated above to suit some needs of the aquaculture sector, the changes have not been far reaching to facilitate the rapid increase of aquaculture in the country. Changes in the structure of the Department of Fisheries that are referred to include the establishment of an aquaculture section and creation of an aquaculture research unit. In the mid1990s the National Aquaculture
Research and Development Centre was established. These positive developments have not yet resulted in significant development in the aquaculture sector in the country because of inappropriate implementation framework.

Another reason why the aquaculture sector in Zambia may not be growing rapidly may be due to the fact that most of the programmes of the Department of Fisheries particularly in provinces where capture fisheries are important, such as Luapula, Northern, Southern, and Western Provinces, are still dominated by those relating to natural fisheries management despite the realisation that aquaculture should be the major priority. Fisheries training programmes at Kaska and at the Natural Resources Development College still tend to have strong bias towards the capture fisheries.

The structure of the Aquaculture Division in the Department of Fisheries is to a large extent a copy of the structure of the Department of Agriculture. The Agriculture extension system has also at a number of times been used to provide extension services to potential and practicing fish farmers. There is therefore concern that methods that may be used to provide extension to crop and livestock farmers cannot be adapted for those farmers that may wish to go into fish farming.

Levels of development in the agriculture and aquaculture sectors are different. Needs of farmers in the aquaculture sector are not the same as those for involved with conventional agriculture. Legislation governing both sectors is also different. This therefore strongly suggests that there is need for designing an institutional arrangement so as to come up with appropriate administrative set up that would catalyse the development of the aquaculture industry in the country. In-depth studies should be undertaken with a view of developing an administrative structure that could facilitate aquaculture development in the country. Such a system should be inclusive taking into account the needs of all stakeholders including financial institutions.

Most of the economic sectors in Zambia have come up with consultative fora such as the Agriculture Consultative Forum (ACF) and the Natural Resources Consultative Forum (NRCF). Fisheries issues could be discussed at any of these fora and if it is considered that a specialised forum is needed then one could be established for this purpose.

### 8.2 Participation of Local Financial Institutions in Aquaculture Development

A study by the Fish Culture Development Project as far back as 1985 established that all commercial fish farmers operating in the country started their aquaculture ventures using their own financial resources. This may be largely because local financial institutions do not have the capacity and experience for funding aquaculture projects. Agriculture experts commonly employed by local rural financial institutions have no training in aquaculture mainly because aquaculture is a recent introduction in local agriculture training institutions. There is need to retrain most of the agriculture experts
employed by financial institutions in basic and key aspects of aquaculture so that they can appreciate fish farming and see aquaculture as a profitable food producing system.

Any meaningful way to develop any rural or peri-urban agriculture systems should involve local financial institutions. For any significant growth in Zambian aquaculture to take place, participation of rural financers is critical.

It is hereby recommended that one of the ways in which aquaculture could be expanded is to create an environment where local financial institutions are able to provide credit to the sector. Some stakeholders interviewed pointed out that most of agricultural sector products that expanded rapidly had an opportunity of being funded. Local, examples include the horticulture, cotton and tobacco industries. The funding proposed for the sector could also be linked to the scheme out-grower scheme proposed in this document (see below). A similar type of fund as those that were established for the horticulture and cotton industries could be established depending on development priorities for aquaculture.

While proposing some type of financial support to the aquaculture sector in order to enhance its growth, it should be pointed out there are several examples of failures in rural financing as well. Examples of poor performance of rural agriculture financing include the experience of the Agriculture Finance Company and the Lima Bank for example. Therefore any form of financial support to the aquaculture sector proposed above should be accompanied by intensive monitoring and periodic reviews.

Another reason for the unsatisfactory performance of agriculture and rural finance in Zambia can be attributed to negative political interference. This aspect is poorly investigated and documented for obvious reasons. However field interviews indicate that in most cases agriculture loans were given to political loyalists as ways of rewarding them for their contributions. If any funding scheme to aquaculture development is to have a positive contribution, it should be implemented outside the Government system. In a situation where there are no indigenous NGOs supporting aquaculture development pursuing such an option has several challenges.

The Zambia National Farmers Union (ZNFU) and the Zambia Peasant Farmers Union are the two associations that could be involved as NGO in the promotion of aquaculture. Currently as pointed out, they are not actively involved in aquaculture as fish farming is not yet a major activity in Zambia in comparison to crop and livestock farming.

Any funding arrangement to support aquaculture development as the one indicated above should be subject to careful analysis of the situation and when implemented should have a clear strategy. Funding innovations for such schemes still need to be developed.

Assessments conducted in 1985 by the Fish Culture Development Project indicated that commercial enterprises that had taken up fish farming were using resources they generated themselves and that nearly all of them did not obtain assistance from financial institutions. This could be one reason for the slow growth of fish farming. Participation of financial institutions, if properly structured, can have positive impacts on aquaculture development. However for financial institutions to participate in aquaculture
some conditions should be met to facilitate development and expansion of aquaculture, including the following:

i) Understanding of fish farming situations and aquaculture as a business by financial institutions;

ii) Financial institutions should develop the capacity to assess and supervise aquaculture projects

iii) Environmental concerns such as adoption of cage fish farming on Lake Kariba need to be addressed, resolved and procedures for the assessment of environmental aspects put in place; and

iv) Laws and regulations to guide aquaculture development should be put in place.

8.3 Aquaculture Extension System

Future aquaculture projects should demonstrate that aquaculture can be a viable income generating activity by targeting its assistance to selected farmers. These selected farmers in districts or agriculture camps can be provided with minimal assistance that they may require in demonstrating to other farmers that aquaculture can generate income for households.

For instance if a selected farmer can construct two fish ponds of 500 m² each, such a farmer may be provided with fingerlings from the DOF Aquaculture station. The local Aqua-culturist or aqua cultural Assistant should visit the target farmers at pre-determined intervals to monitor progress of the projects and to assist in record keeping.

When the farmer crops his or her demonstration fishponds that have been monitored, a field day should be organised. People to be invited at such field day should include community leaders such as Local Councillors Church Leaders, Head of Government Departments in the area, Representatives of NGOs operating in the district or camp local business people, etc. The objective of such field days should be to expose the farming community and community leaders to the idea that aquaculture could generate incomes for households.

The strategy for aquaculture development has put more attention on fisheries extension and has focused in assisting households in remote parts of the country to improve food security. Such a strategy needs diversification in order to address the different needs of the sector. It has now been realized that supporting economically viable private businesses can also bring about community development in several ways such as: employment: and in marketing and supply of fingerlings in the case of fish farming. Establishment of an out-grower scheme would be one way of assisting more market oriented aquaculture and would also support small-scale fish farmers. A commercial farmer operating in an area, for instance, could be a source of inputs such as fingerlings and feeds for small scale fish farmers. Such a commercial farmer could have strong links to the market and could buy produce from small scale fish farmers. Such an arrangement is common in the capture fisheries on Lake Tanganyika where artisanal
fishers sell their catches to commercial fishing companies that have the capacity to process the fish and later sell it to consumers and retailers in urban areas. Aquaculture development should investigate possibilities for establishing out grower schemes for aquaculture.

Establishment of out-grower schemes could be implemented jointly with the recommendation for demonstrating aquaculture as a commercially viable enterprise. Aquaculture operations could operate profitably under an out-grower scheme. Such schemes could assist in marketing.

Fish pond productivity among the small scale fish farmers is generally low. This may be due to lack of knowledge on best fish farming practices or poor designs of fishponds and fish farms. There is still room for aquaculture extension in order to improve productivity in the small scale sector. Improved extension to fish farmers should aim at the following:

i) Increasing pond fish productivity:
ii) Facilitating existing fish farmers to expand their fish farms so that they are able to take up fish farming as a core farm activity;
iii) Encouraging farmers who have the potential to take up fish farming;
iv) Reorganise the sector such that fish farming becomes a major fish producing venture for local and export markets; and
v) Developing the business capability of existing and potential fish farmers

In the past the Department of Fisheries has tried several fish extension approaches through different projects and none of them seem to have triggered the development of aquaculture. In the mid 1990s the Ministry of Agriculture attempted to merge agriculture and fisheries extension sections into one Department of Field Services as explained above. Even though this strategy has some advantages, in practice, it was realized that Agriculture Extension was different from that for Aquaculture.

It seems therefore as though what has not yet been done intensively in the promotion of aquaculture is to provide a strong link between production and marketing. Future aquaculture extension programmes should therefore strive to provide a strong link to the market with a view to commercialising it and not put great emphasis and not to put all the attention on food security (availability of fish protein for the family) as has been the case in the past. Strong linkage to the market after all does not reduce food security. Money obtained by selling the fish also improves food security as it enables households to purchase other food items that they need.

8.4 Specialisation in Aquaculture

Hassan (2004) observed that the Zambian aquaculture sector does not have specialists in the various areas of aquaculture. This causes serious challenges in that the country may not have the capacity to deal with all the problems that may be needed in the development of the sector.
The structure of the Department of Fisheries should have provisions for specialisation in its staff establishment. Initially positions at the level of Senior Aquaculture Officers should be established with specialisations in the following disciplines of aquaculture: fish seed propagation; fish breeding; fish pathology; fish feed and nutrition; and pond limnology. Such positions should be established at the NARDC and should facilitate implementation of key research programmes that are required to support development of aquaculture.

8.5 Strengthening Aquaculture Research

Aquaculture research needs intensification, and be designed in a manner that it is more responsive to the needs of the industry. Most of the aquaculture research conducted in Zambia was confined to acclimatizing species under prevailing local conditions mainly in Chilanga at the Headquarters of the Fish Culture Division. During the 1980s and 1990s research in aquaculture focused on identifying and testing ideal species and system for monoculture of *Tilapia*, and mass production of both *Tilapia* and Carp fingerings.

There is therefore need to develop capacity for implementation of aquaculture research in different parts of the country. Aquaculture research should put more emphasis on trials aimed at culturing more local species, producing fish feeds from locally available materials and improving the quality of fish pond environments. The facilities at NARDC have the capacity to achieve this level of research. However, the work of the National Aquaculture Research and Development Centre should be supported with fish farming trials conducted in different parts of the country.

The introduction of cage fish farming calls for more research particularly in the area of fish feeds. As already indicated fish feeds are very expensive mainly because some of the ingredients used are not available locally. Research in fish feed formulation would make positive contribution to the development of aquaculture.

The species used in cage aquaculture, *Oreochromis niloticus* is not indigenous to the Zambezi River system. There are serious environmental concerns that use of this species. Research aimed at using some of the indigenous species would be a welcome development.

8.6 Strengthening Aquaculture Training Institutions

Fisheries training, as currently implemented in training institution where fisheries training offered is designed, mainly focuses on management of the capture fisheries. The Diploma Programme offered at NRDC and the Certificate Course in Fisheries offered at Kasaka illustrate this situation. In order to facilitate commercialisation, intensification, development and expansion of aquaculture, the training programmes for the fisheries sector could include the following aspects;

i) Reorganisation of the Diploma Course at NRDC to include several aspects and courses in aquaculture;
ii) The first or second years of the programme could be more general but the third year of the Diploma course in should offer an option for specialisation either in natural fisheries management or aquaculture; iii) The certificate course offered in fisheries at Kasaka should also be reorganised to offer more courses in aquaculture; iv) The first year of the training programme could offer subjects that are common to both capture fisheries and aquaculture and the second year of the programme should prepare students for joining either the capture fisheries or aquaculture; v) There should be short courses, for a maximum period of two weeks, aimed at sensitising farmers, community leaders key members of financial institutions about the value of fish farming; vi) Re-training of Department of Fisheries staff in new extension methods and latest aquaculture methods; vii) Training fish farmers and aquaculture technicians in feed formulation and manufacturing; viii) Training of fish farmers and potential fish farmers in record keeping and farm accounts; and ix) Harmonisation of fisheries and aquaculture training programmes.

Sensitisation of community leaders and members of financial institutions supporting agriculture enterprises is considered critical to the development of fish farming as a commercial undertaking. Training in record keeping is very important for co-operatives and fish farming groups engaged in aquaculture.

As for the ICAT programme, fisheries training staff should take a leading role in the organization of the training programme rather than researchers. This arrangement would help researchers to devote more time to their primary duties. If the DoF training staff were actively involved in organising the programme, it would facilitate in conducting more sessions. Partners supporting the fisheries sector should investigate possibilities for strengthening the ICAT and similar programmes. One way of achieving sustainability of programmes such as the ICAT Training programme could be by offering training for participants from NGOs, other development organization, farmers’ association, commercial enterprise and private individuals at full cost.

Aquaculture training at the two Universities, the CBU and UNZA does not have any infrastructure and equipment for the courses offered in fish farming. When the courses in aquaculture were introduced, they were not supported by a budget to put up the appropriate infrastructure and to procure the equipment. The courses are offered with support from commercial fish farmers who are willing to use their facilities to demonstrate fish farming to students. Future aquaculture development interventions should prioritize provision of aquaculture training infrastructure to both universities.

8.7 Strengthening Linkages and Cooperation

It is also clear that there are no formal links among aquaculture training institutions and aquaculture projects, within the country for cooperation and exchange of information
relating to aquaculture development projects and programmes. In addition there is no institutional link between the Department of Fisheries and commercial fish farmers. In the 1980s and the 1990s when there were several aquaculture projects operating in the country, each project developed its programmes in isolation. Results of each project were not shared with other projects that were operating in different parts of the country.

Zambia has however linkages to international and regional organizations such as FAO and SADC that facilitate cooperation in fisheries and aquaculture. However cooperation with such organization is restricted and confined to the public sector.

Future aquaculture development projects should aim at establishing strong local NGOs in aquaculture that could be linked to other NGOs at regional and international levels.

8.8 Aquaculture and the Environment

The Draft of the Fifth National Development Plan prepared by the Department of Fisheries aims at increasing fish production. Priority of the plan is to raise aquaculture production, as the capture fisheries are in most cases fully and sometimes over exploited. Commercialisation and intensification of aquaculture are envisaged to be one of the strategies for increased output from fish farming.

Cage fish farming is also considered as one of the methods through which fisheries and aquaculture production could be increased. If cage aquaculture is to play a major role in increasing aquaculture and fisheries production, key environmental issues such as: use of exotic specie; application of chemical for treating fish that is farmed in public water bodies, should be resolved by stakeholders particularly the Department of Fisheries, The Environmental Council of Zambia (ECZ, [http://www.cecz.org.zm/](http://www.cecz.org.zm/)) and cage fish farmers.

The ECZ views aquaculture as an environmental hazard and currently requests for an Environmental Impact Assessment (EIA) for each cage fish farming operation on Lake Kariba for instance. Instead of demanding for an EIA for each cage fish farming project, key stakeholders in cage fish should undertake or facilitate the implementation of a lake wide environmental impact assessment for cage fish farming on Lake Kariba. This EIA could be followed by similar assessments on other water bodies targeted for cage fish farming. Such an approach will facilitate development of intensive fish farming operations and accelerate development of aquaculture.

8.9 Preparation of the National Fisheries Policy Document

The Department of Fisheries has initiated preparation of the National Fisheries Policy Document. This draft contains chapters that will provide guidance to aquaculture development. Finalization and adoption of such a policy document will facilitate aquaculture development as is provide the required policy framework to be used in the formulation of fisheries development plans and fisheries legislation.
REFERENCES


Balarin, J. D., 1984 National Reviews for Aquaculture development in Africa FAO Fish Circ., (770 1)


CSO (200) Living Conditions and Monitoring Survey Report


Department of Fisheries, 2007: Fisheries Statistics. Ministry of Agriculture and cooperatives


Export Board of Zambia (1999) Market Survey of Zambia's Fish and Fish Products (electronic version)

F. A. O. Fisheries Department, 1997. The state of world Fisheries and aquaculture Food and Agriculture Organisation of the United Nations,

FAO 2002 Yearbook of Fishery Statistics, Aquaculture Production


IPS., 2002 State of the natural fisheries in Zambia: An inception report for the formulation of the medium term plan for the fisheries sector: Ministry of Agriculture and Co-operatives


# LIST OF PERSONS CONTACTED

## Government Officials

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>Position</th>
<th>Organization</th>
<th>Contact Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mr. C. T. Maguswi</td>
<td>Director</td>
<td>Department of Fisheries</td>
<td>P. O Box 350100 Chilanga</td>
</tr>
<tr>
<td>2</td>
<td>Mr. Killian Kalonga</td>
<td>Chief Fisheries Officer</td>
<td>Department of Fisheries</td>
<td>P. O Box 350100 Chilanga</td>
</tr>
<tr>
<td>3</td>
<td>Mr. John Mwanga</td>
<td>Chief aquacultural Research Officer</td>
<td>Department of Fisheries</td>
<td>P. O Box 350100 Chilanga</td>
</tr>
<tr>
<td>4</td>
<td>Mr. Martin M. Chilala</td>
<td>Chief Fish Culturist</td>
<td>Department of Fisheries</td>
<td>P. O Box 350100 Chilanga</td>
</tr>
<tr>
<td>5</td>
<td>Mr. Timothy Phiri</td>
<td>Chief Fisheries Training Officer</td>
<td>Department of Fisheries</td>
<td>P. O Box 350100 Chilanga</td>
</tr>
<tr>
<td>6</td>
<td>Sidney M. Maboshe</td>
<td>Provincial Fisheries Officer</td>
<td>Department of Fisheries</td>
<td>P.O Box 710005 Mansa</td>
</tr>
<tr>
<td>7</td>
<td>Rutendo Chitembure</td>
<td>Senior statistician</td>
<td>Ministry of Health</td>
<td>Ndeke House P.O Box 30205 Lusaka Email: <a href="mailto:chitembure@yahoo.com">chitembure@yahoo.com</a> <a href="mailto:chitembure@moh.gov.zm">chitembure@moh.gov.zm</a></td>
</tr>
<tr>
<td>8</td>
<td>Albert Kayamba</td>
<td>Director, Planning</td>
<td>Ministry of Local Government and Housing</td>
<td>P.O Box 50027 Lusaka Email: <a href="mailto:kayambaz@yahoo.com">kayambaz@yahoo.com</a></td>
</tr>
<tr>
<td>9</td>
<td>Mr. Malcom Dimuna</td>
<td>Fisheries Assistant</td>
<td>Department of Fisheries</td>
<td>P. O. Box 85 Siavonga</td>
</tr>
<tr>
<td>10</td>
<td>Baldwin Chibuta</td>
<td>Extension Officer</td>
<td>Department of Fisheries</td>
<td>Fisheries P.O Box 350100 Chilanga email: <a href="mailto:bchibuta@yahoo.com">bchibuta@yahoo.com</a></td>
</tr>
</tbody>
</table>
## Training Institutions

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>Position</th>
<th>Organization</th>
<th>Contact Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dr. Moses Daura</td>
<td>Head</td>
<td>University of Zambia</td>
<td>Department of Animal Sciences P. O. Box 32379 Lusaka</td>
</tr>
<tr>
<td>2</td>
<td>Mr. T. Zimba</td>
<td>Head</td>
<td>Natural Resources Development College</td>
<td>Department of Fisheries P. O. Box 31009 Lusaka</td>
</tr>
<tr>
<td>3</td>
<td>Mr. Conrad Musuka</td>
<td>Lecturer</td>
<td>Copper Belt University</td>
<td>School of Natural Resources P. O. Box 3162 Kitwe</td>
</tr>
<tr>
<td>4</td>
<td>Mr. K. Luaba</td>
<td>Acting Head</td>
<td>Natural resources Development College</td>
<td>Fisheries Department Natural Resources Development College P. O. Box 31009 Lusaka</td>
</tr>
</tbody>
</table>

## Private Sector

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>Position</th>
<th>Organization</th>
<th>Contact Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Malaila Sharon</td>
<td>Administration Assistant</td>
<td>Chirundu Bream Farm Ltd</td>
<td>P. O. Box 320211 Woodlands Lusaka Email: <a href="mailto:maltembele@zamnet.zm">maltembele@zamnet.zm</a></td>
</tr>
<tr>
<td>2</td>
<td>David Kaunda</td>
<td>Chief executive</td>
<td>KLM Aquaculture</td>
<td>P.O. Box 51282 Ridgeway Lusaka Email: <a href="mailto:ikmague@zamtel.zm">ikmague@zamtel.zm</a></td>
</tr>
<tr>
<td>3</td>
<td>Tim Fuller</td>
<td>Managing Director</td>
<td>Chirundu Bream Farm Ltd</td>
<td>P. O. Box 320211 Woodlands Lusaka Email: <a href="mailto:maltembele@zamnet.zm">maltembele@zamnet.zm</a></td>
</tr>
<tr>
<td>4</td>
<td>Ms. E. C. Thomas</td>
<td>Manager</td>
<td>Kalimba Farms</td>
<td>P. O. Box 3456 Lusaka Zambia Email: <a href="mailto:kalimba@zamnet.zm">kalimba@zamnet.zm</a></td>
</tr>
<tr>
<td>5</td>
<td>Kenneth Kapanda</td>
<td>Part time lecturer in Aquaculture</td>
<td>World Vision</td>
<td>P.O box 31083 Lusaka Email: <a href="mailto:keneth_kapande@wvi.org">keneth_kapande@wvi.org</a></td>
</tr>
</tbody>
</table>
Appendix 1

Table 1a & b Shows Zambia’s fisheries production from Lakes, Rivers and Swamps

<table>
<thead>
<tr>
<th>ZAMBIAN FISHERIES PRODUCTION ESTIMATES IN METRIC TONNES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other fishes, except kapenta</td>
</tr>
<tr>
<td>Bangweulu</td>
</tr>
<tr>
<td>Mweru-Luapula</td>
</tr>
<tr>
<td>Tanganyika</td>
</tr>
<tr>
<td>Kafue</td>
</tr>
<tr>
<td>Kariba</td>
</tr>
<tr>
<td>Lukanga</td>
</tr>
<tr>
<td>Upper-Zambezi</td>
</tr>
<tr>
<td>Lusiwashi</td>
</tr>
<tr>
<td>Lower Zambezi</td>
</tr>
<tr>
<td>Itezhi-tezhi</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
## KAPENTA PRODUCTION FIGURES FROM RETURNS RECEIVED

<table>
<thead>
<tr>
<th>COMMON NAME</th>
<th>Scientific Name</th>
<th>Other Freshwater fishes</th>
<th>Aquaculture (carp fish &amp; bream)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stolothrissa, Limnothrissa spp.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1995</td>
<td>70,546</td>
<td>4,081</td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>66,332</td>
<td>4,770</td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td>65,923</td>
<td>4,718</td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>69,938</td>
<td>4,159</td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td>8,955</td>
<td>67,327</td>
<td>4,180</td>
</tr>
<tr>
<td>2000</td>
<td>9,176</td>
<td>66,671</td>
<td>4,240</td>
</tr>
<tr>
<td>2001</td>
<td>5,666</td>
<td>63,000</td>
<td>4,520</td>
</tr>
<tr>
<td>2002</td>
<td>4,416</td>
<td>63,000</td>
<td>4,630</td>
</tr>
<tr>
<td>2003</td>
<td>7,481</td>
<td>66,332</td>
<td>4,450</td>
</tr>
<tr>
<td>2004</td>
<td>6,574</td>
<td>67,725</td>
<td>4,638</td>
</tr>
<tr>
<td>2005</td>
<td>6,251</td>
<td>65,927</td>
<td>5,125</td>
</tr>
<tr>
<td>2006</td>
<td>7,659</td>
<td>60,236</td>
<td>5,210</td>
</tr>
<tr>
<td>2007</td>
<td>9,476</td>
<td>73,542</td>
<td>5,876</td>
</tr>
<tr>
<td>2008</td>
<td>11,890</td>
<td>79,403</td>
<td></td>
</tr>
</tbody>
</table>